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Trends

Crude-Oil Production
By States — Page 92

CRUDE-OIL STOCKS 240,992,000 bbl. as of Jan. 1—down 318,000. One year ago 233,938,000 bbl.

GASOLINE STOCKS 76,302,000 bbl. as of Jan. 1—up 2,278,000 bbl. One year ago 80,472,000 bbl.

RESIDUAL FUEL-OIL STOCKS 57,330,000 bbls. as of Jan. 1—down 266,000. One year ago 72,672,000.

GAS OIL AND DISTILLATE 42,431,000 as of Jan. 1—down 1,360.000 bbl. One year ago 44,833,000.

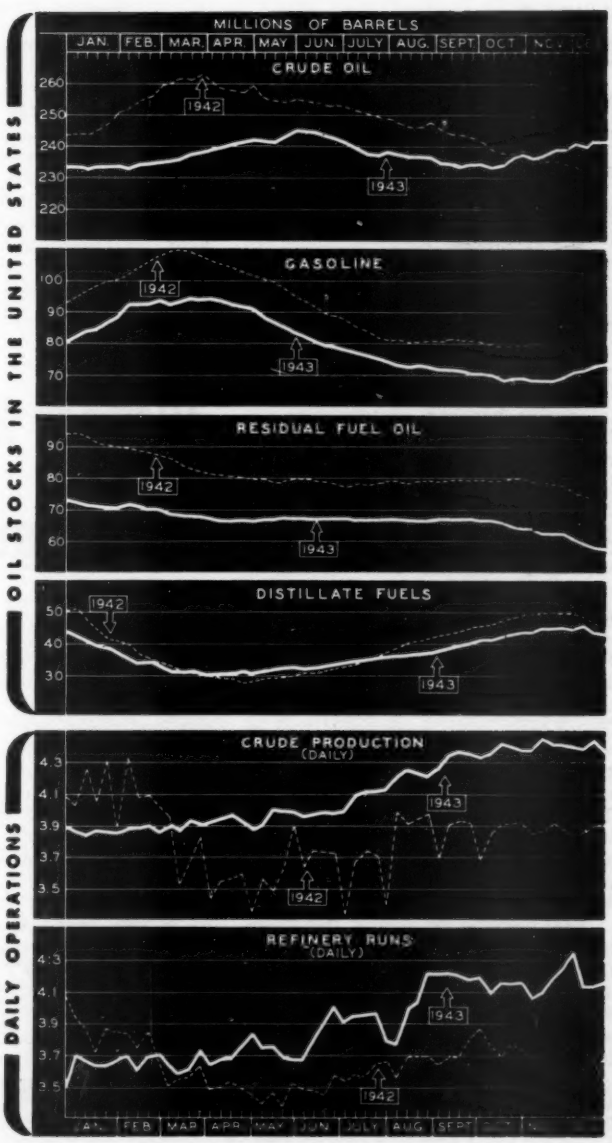
CRUDE-OIL PRODUCTION 4,366,220 bbl. daily average—up 8,080 bbl. One year ago 3,832,830.

REFINERY RUNS 4,453,000 bbl. daily week ended Jan. 1—up 268,000 bbl. One year ago 3,716,000.

THE latest reports of the United States Department of Labor, released since the first of the year, are of interest to the petroleum industry as reflecting price and employment conditions up to the fall months of last year. The reports show that the wholesale price index for petroleum and products in October was 63.5, which compares with an all-commodity index of 103. Since the start of the World War in August 1939, this represents an increase of 22.8 per cent for petroleum, 56.4 per cent for foods, 44 per cent for textile products and 25.8 per cent for building materials. These comparisons show little change from those in effect earlier in 1943, but do reveal that petroleum and refinery products continue in the lowest relative price position of all the major commodities.

IN the matter of employment the government reports in the case of the petroleum industry, unfortunately, are largely confined to the refining division. Independent investigations, however, have shown that the trends in refinery employment have been largely duplicated in crude-oil production and pipe-line operation. It was estimated that all of the war and regular operations of the refining industry were being carried on in September 1943 with 82,300 wage earners. This compares with an estimated employment of 738,000 in the automobile industry, 1,721,000 in all phases of the iron and steel industry, 1,185,000 in textile mills and 1,104,000 in the food industries. The percentage increase in refining employment has been less than in many other war industries. This comparison does not include construction employes.

IN regard to the wage-earner employment index, that of petroleum refining in September, was 113 and the wage-earner payroll index was 184.8. Relative to earnings the latest report shows that the average weekly earnings of employes in petroleum refining in September was $55.20. The average weekly hours were 44.9 and the average hourly earnings were $1.224. For manufacturing generally, according to the government's report the average weekly earnings were $44.39, weekly hours, 44.7, and average hourly earnings 99.3 cents. These reports on earnings only partially reflect the actual advance in costs in petroleum refining. The largest increases have come in the costs of materials and equipment, which in turn have been brought about by the higher weekly and hourly earnings of many industries which sell to the petroleum industry.



Modification of Demand Necessary to Stop Drain On California Oil Stock

LOS ANGELES, Calif. — Two possible methods for relieving the gasoline shortage on the Pacific Coast are under consideration by federal agencies charged with the responsibility of maintaining essential supplies. Gasoline consumption on the Pacific Coast, current data disclose, is exceeding the new supply by about 18,000 bbl. daily.

Since the start of May, 1942, motor-fuel stocks in California have been reduced more than 7,000,000 bbl., and now stand at 14,211,000 bbl., the lowest level in recent history.

A report that the Office of Defense Transportation had assigned 70,000 tank cars for the purpose of moving additional volumes of petroleum products from the Gulf Coast to California is discounted in official quarters. Railroads serving the West Coast, it is pointed out, are not equipped to handle any substantial increase in the 5,000 cars currently in service between southwestern refining centers and California terminals. Current tank-car movement into California is averaging 45,000 bbl. daily, and while moderate increases are planned by the industry and by the Petroleum Administration for War it is conceded that method of supplementing supplies does not offer a complete solution.

Total demand for gasoline in the Pacific Coast territory rose from 178,000 bbl. daily in January, 1942, to a current level of about 310,000 bbl. The figures cover exports as well as domestic consumption. Secrecy orders prevent segregation of domestic demand and off-shore movements. There has been a slight modification in motor-fuel consumption since last year's high mark of 331,000 bbl. daily in September, but the lull is only temporary.

Total demand for all oils, the American Petroleum Institute current report discloses, has tapered off slightly since September but still stood at 962,000 bbl. daily in November against 748,000 bbl. at the start of last year.

Production of gasoline through the first 11 months of 1943 averaged 235,000 bbl. daily, including natural gasoline blended and reforming operations. This production figure compares with average demand of 268,000 bbl. daily for the same period, indicating a deficiency of approximately 33,000 bbl. daily.

Second Alternative

The other alternative open to officials for dealing with the California petroleum supply situation is a reduction in civilian consumption, a step already taken voluntarily by refiners. Deliveries to service stations were arbitrarily cut to 80 per cent of normal at the start of December and a further reduction was made last week. Pending completion of administrative details is a priority system through which certain stations will be designated as defense suppliers. Defense stations will be allocated sufficient gasoline to meet requirements of war-plant workers and it is assumed that other stations will suffer corresponding reductions in the deliveries by their regular sources.

The short position of motor fuel, officials point out, is particularly discouraging for maintenance of current civilian supplies because of the certainty that off-shore movements will be expanded substantially in the near future. In fact, the current position is partially a disclosure resulting from a recheck of available supplies on the West Coast made by military authorities and PAW officials. Investigation disclosed, it is reported at Washington, D. C., that some of the stock previously carried as unfinished motor fuel and therefore lumped into the total inventory figure, is not qualified for gasoline. Changed manufacturing conditions, of course, are partially responsible for reclassification of inventory because certain steps previously available to refiners in production of civilian products are no longer possible under wartime restrictions.

Another aspect concerning operators and PAW officials is the inability of California's producing fields to meet the emergency demand. Current allocation to California producers is approximately 873,000 bbl. daily of total petroleum liquids and withdrawals are falling at least 30,000 bbl. a day behind schedule.

District 2 Refiners Propose Ways To Augment Inherent Supplies

WASHINGTON, D. C.—Ways and means of obtaining additional crude for Mid-Continent refineries were discussed with several government agencies by a group of about 50 District 2 refiners in Washington January 10 and 11.

Under the chairmanship of B. L. Majewski, Chicago, vice president of Deep Rock Oil Corp., the group conferred with Fred M. Vinson, economic stabilization director, and officials of Defense Supplies Corp. in an attempt to secure broadening of the DSC compensatory payment for tank-car shipments of crude from West Texas, which is now limited to refiners not in the excess-profits bracket. They received no definite reply but a promise to study the matter further.

Various other problems were discussed with PAW officials, including further liberalization of drilling restrictions in Illinois; drawing off crude oil from the big-inch line at Norris City, Ill.; using the western leg of the 20-in. for crude; estimates of the number of tank cars that will be available for District 2 crude movements when the 20-in. line is completed; reversal of the Tuscarora or some other line now taking crude to District 1; war products crude requirements of District 1; nature of excess refining capacity in District 2 and the volume suited to making war products; reversal of pipe lines now carrying crude from District 2 to District 3; and various other suggestions for dealing with the crude shortage and excess refining capacity.

No definite solution was agreed on, but the subject was expected to be laid before the Petroleum Industry War Council later in the week with specific recommendations for action.

International-Oil Plan Discussed As Reversal of Lend-Lease Operations

by Henry D. Ralph

WASHINGTON, D. C. — An international petroleum agreement based on the "reverse lend-lease" idea, with the world's oil resources treated somewhat as a common pool and used, together with other basic commodities, to repay international debts, is hinted by President Roosevelt in his thirteenth report to Congress on lend-lease operations.

This is the first time a lend-lease report has mentioned oil, and is considered to be an answer to complaints in Congress and elsewhere that the United States is furnishing too large a quantity of petroleum products to the United Nations. The report minimizes the total lend-lease oil exports and declares that much is being done to develop petroleum sources outside of this country but that this will not provide much relief for domestic consumers.

The world oil plan is sketched in very broad terms, but it dovetails with suggestions of postwar international plans which have been discussed in other high administration quarters. Discussing conditions after the war, the President said: "Agreed action by the nations of the world, as provided in the master lend-lease agreements, for expansion of production, the elimination of discriminatory treatment in commerce, and the reduction of trade barriers, will assure to the United States and other nations fair and equal access to the petroleum produced in all parts of the world."

Broad Terms Outlined

This is in line with a somewhat more detailed plan which has been proposed "as a suggestion for discussion" by Harold L. Ickes, secretary of the interior and president of the government-chartered Petroleum Reserves Corp. His plan included government control of foreign-oil operations and huge stockpiles of imported oil stored in strategic points in the United States.

A not dissimilar plan for all natural resources is being discussed by the Treasury and State departments in connection with suggestions for settling international balances, paying war debts, and stabilizing currencies. This contemplates government imports of raw materials, including perhaps $300,000,000 of petroleum the first year of normal peacetime conditions, and storing it indefinitely except for a turnover to prevent deterioration. Such a plan would permit foreign nations to repay their lend-lease obligations and provide them with foreign exchange to finance exports of U. S. manufactured goods.

The lend-lease report gives no details of petroleum exports, except to remark that the Soviet Union has received 611,000 tons of petroleum products from the beginning of its lend-lease program to the end of October, 1943. The only breakdown of exports from the start of lend-lease program in March, 1941, through October 31, 1942, which shows the following, in millions of dollars:

LEND-LEASE SHIPMENTS
(Millions of dollars value)

Consignee	Petroleum products	Total exports
United Kingdom	423	5,980
U.S.S.R.	27	3,550
Africa, Middle East	61	2,168
China, India, etc.	97	1,603
Other countries	..	543
Total	608	13,844

One section of the report defends shipments of gasoline to French North Africa. Other highlights include:

The war is taking about 88 per cent of all petroleum produced in this country.

Current exports of oil to all countries are less than before the war.

Lend-lease oil exports are less than one-tenth of U. S. production.

Petroleum production in the Middle East has already surpassed the prewar level. The Abadan refinery in Iran is operating at top output and all refining facilities in the area are being utilized to the fullest extent permitted by available tankers. The refinery at Bahrein is being expanded.

Several refineries have been sent to Russia under lend-lease.

The over-all petroleum war needs of the United Nations will increase above the current rate.

No Relief in Demand

Additional supplies of oil from foreign sources will not reduce demands on the United States.

Excerpts from the chapter of the report on "Lend-lease Petroleum in the War" follow:

Petroleum production in the Middle East has already surpassed the level of prewar production, and current production is greatly in excess of the production of 2 years ago when the whole area was threatened with the danger of falling under Nazi control. British corporations in the Middle East control several times the production and refining capacity controlled by United States corporations in that area and are consequently supplying several times the quantity

PRC Reported Negotiating for Kuwait Participation

NEW YORK — Unconfirmed reports were circulated here this week that Petroleum Reserve Corp. is negotiating with Kuwait Oil Co., Ltd., for participation in development of the company's concession. The company, jointly owned by Gulf Oil Corp., and Anglo-Iranian Oil Co., Ltd., controls sole prospecting and exploitation rights in the Sheikh of Kuwait's territory on the northwest angle of the Persian Gulf, covering nearly 4 million acres.

Substantial production has been developed in Kuwait since exploratory operations were started in 1938. Reserves already proven are generally thought to be in the billion-barrel class although the operators have declined to give detailed information since the discovery well hit production between 3,600 and 3,800 ft.

On December 28, Harold L. Ickes, president of the Petroleum Reserve Corp. and J. Frank Drake, president of Gulf Oil Corp., spent more than an hour visiting at the White House just after the President returned from his trip to Cairo and Teheran where petroleum affairs were discussed as an important part of the general war strategy.

of petroleum products supplied from oil resources in that area controlled by United States interests.

The British government, which has had a substantial military supply responsibility in the Middle East, has greatly expanded the petroleum facilities in that area. The first stage of the expansion of the Abadan refinery was begun in the fall of 1941 and the expansion is continuing. The capacity of the British-controlled refinery at Haifa is also being expanded and the refinery at Suez has been operated at full capacity throughout the period of active warfare in this area. The expansions of facilities at these refineries are being paid for by the British. They have not been carried out with lend-lease funds.

A project has also been undertaken to expand the output of war products of the refinery at Bahrein, halfway down the Persian Gulf. This refinery is owned by United States corporations and equipment supplied from the United States for the expansion project is being paid for by the companies with the assistance of a loan from the Defense Supplies Corp.

The United States, with minor exceptions, does not pay for petroleum products currently obtained from the Middle East. Practically all bunker oil for United States naval and merchant vessels in the Middle East is provided by the British government under reverse lend-lease. Petroleum products of all types shipped from the Middle East refineries to Australia, India, South Africa, and to the Mediterranean area are furnished locally to United States armed forces and merchant vessels under reverse lend-lease.

Most of the petroleum products used by the Soviet forces are from Soviet petroleum sources, but certain vitally needed petroleum products for the Soviet war effort not refined in sufficient quantities in the U. S. S. R. have been supplied from the United States under lend-lease. Under lend-lease several refinery units have been sent to the Soviet Union in order to enable the Soviet Union to increase its production of aviation gasoline and other high-grade petroleum products from her own petroleum resources. The Soviet Union has also received petroleum products from British resources.

Outlook for the Future

Every effort is being made to increase the crude-oil production, the refining capacity, and the supply of tankers available to the United Nations. The over-all petroleum war needs of the United Nations in 1944 will rise above what they are now as the magnitude of our offensive increases. The increasing numbers of planes, ships, and tanks which we are now producing and putting into action against the enemy require increasing quantities of gasoline, oil, and lubricants.

Additional supplies of petroleum products from other areas will not therefore result in reducing the demands on our own petroleum resources. All available supplies of petroleum products will be required for a speedy and complete victory of the United Nations over the enemy.

Three Standard of Ohio Subsidiaries Merged

CLEVELAND, Ohio.—Several subsidiaries of Standard Oil Co. (Ohio), operating principally outside of this state, were merged January 1 into Sohio Petroleum Co. Consolidated companies are Sohio Producing Co., a crude-oil producing organization; Sohio Corp., a crude-oil purchasing and gathering organization, and Latonia Refining Co., which operates a refinery at Latonia, Ky. Simplification of the company's corporate structure was the objective.

Officers of Sohio Petroleum Co. are: W. T. Holliday, president; S. A. Swensrud, G. W. Hanneken, W. J. Semple, and J. F. Wilson, crude-oil purchasing; John P. Smoots and Earl D. Wallace, in charge of exploration and producing divisions.

Method for Excluding Water From Oil Wells Developed by Kansans

LAWRENCE, Kans. — A process which promises to effect the recovery of many thousands of barrels of petroleum for Kansas oil men and other producers has been successfully completed at the University of Kansas through research in the department of petroleum engineering, Dr Eugene A. Stephenson, chairman of the department, announced last week. Application for patents on the process have been filed and results of the work will be published this spring by the University of Kansas Research Foundation, of which Stephenson is executive director.

Research on the oil project was financed by a grant for industrial research from the Kansas legislature and was further subsidized by three major oil companies—Cities Service Oil Co., Phillips Petroleum Co., and Stanolind Oil & Gas Co. The technical work was done chiefly by P. T. Amstutz, now associated with Standard Oil Co. of Ohio, under the supervision of Stephenson.

In the development of an entirely new technique for the exclusion of water from oil wells, 13 wells have been treated by the process within the past 2 years and thousands of barrels of water-free oil produced. Other thousands have been produced with much decreased percentages of water. Some wells which were producing as high as 50 per cent water nearly 2 years ago, are now producing no water at all. Others are producing but a small fraction of the water formerly lifted.

For years, Stephenson said, oil companies have spent enormous sums in efforts to prevent the incursion of water into oil wells, for the continued replacement of equipment corroded by the highly active brines, and for the disposal of the brines through specially drilled wells.

Gasoline Priority System Imminent for District 5

LOS ANGELES, Calif.—Ralph K. Davies, deputy petroleum administrator, in a press conference in Los Angeles last week, indicated that the Government may divert gasoline to certain designated service stations which will serve warworkers exclusively.

Davies said that if gasoline consumption continues at the present rate the projected plan might be put into operation within the next 30 days.

Reese H. Taylor, president of Union Oil Co. and chairman of the public relations committee of the California Oil and Gas Association, was severely critical of OPA which has transferred A, B and C ration coupons into hunting licenses, charging that OPA has bungled the situation. Taylor said that OPA has done everything from the start to hinder the oil industry both in rationing and prices. "It is utterly ridiculous," he went on, "to have them writing out coupons without considering the available gasoline supply for civilians. They don't know how many coupons are out nor how fast they are used. They have almost no control over the rate of use."

Oklahoma Engineers Hold Meeting January 15

The Oklahoma Society of Professional Engineers will hold its state meeting and business session in Tulsa January 15. Gerald H. Westby, president, Seismograph Service Corp., Tulsa, will address a joint luncheon meeting at noon of the O.S.P.E. and the Tulsa Engineers Club.

The evening banquet speaker will be Charles T. Evans, assistant to the president, Arkansas Power & Light Co., Little Rock, Ark. H. G. Thuesen, acting assistant dean of engineering, Oklahoma A. & M. College, Stillwater, Okla., will serve as banquet toastmaster.

THIS WEEK

PRODUCTION—Arrest of dwindling supplies in Illinois proposed by District 2 refiners. . . . Suggest relaxation of spacing restrictions, in order to supplement crude-oil supplies within the district. . . . ¶California falling notably behind quotas, heavier drain imminent aggravating situation. . . . . ¶Shipments west from Billings, Mont., may be started next fall. . . . Meanwhile overland shipments and imports must absorb shock of higher demand. . . .

DRILLING—Wildcat completions start year at increased level, results are not, however, in line with drilling pace. . . . Two small discoveries are net result of week's activity. . . . ¶Projected drilling rate calls for increases during first and second quarters, reaching peak in third, with slight modification expected in final 3 months. . . . ¶Failure of many fields to equal expected sustained productivity elevates 1944 drilling program from "desirable" to "must" status. . . .

TRANSPORTATION—Recommendations under consideration for drawing off part of 24-in. throughput at Norris City, Ill., for using 20-in. to move crude into District 2, pending completion of the east extension. . . . ¶Big-inch movement sustained at 300,000 to 310,000 bbl. daily. . . . ¶Chicago-to-Toledo 8-in. line 95 per cent complete. . . . ¶Looping program planned for Gulf Refining Co.'s West Texas system will increase capacity 16,000 bbl. daily. . . . ¶Stanolind Pipe Line Co.'s 16-in. line from West Texas to Oklahoma about one-third laid. . . .

SUPPLIES—Kerosene in critical demand in practically all parts of country. . . . Light fuel-oil inventory improving on East Coast, consumption restrictions may be modified. . . . ¶Gasoline remains critically short in most areas, acute and deteriorating on the Pacific Coast. . . . ¶Federal spokesmen are talking in terms of 400,000 bbl. per day imports by midyear, possibly earlier. . . .

INTERNATIONAL—President outlines broad plan for virtual pooling of world petroleum resources, using lend-lease technique in reverse. . . . ¶Petroleum Reserve Corp. reported negotiating with Kuwait Oil Co., Ltd., for participating in Persian Gulf concession which covers nearly 4 million acres. . . . ¶Plans rapidly taking shape for increased activity in Venezuela. . . . Another pipe line to serve eastern fields, new drilling, possibly a large refinery and new shipping facilities included. . . . ¶Expansion of Bahrein Petroleum Co. refinery in Persian Gulf confirmed by President Roosevelt who also revealed that additions are under way at the Haifa plant. . . .

Imminent invasion of western Europe and promised intensification of the Pacific war operations shrink this picture of Marines and Seabees rolling drums of gasoline ashore on the Gilbert Islands into a minute phase of operations. It serves, however, to illustrate the task of fueling invasion forces and indicates extent of the petroleum industry's assignment in the vastly expanded war program for 1944

Press Association, Inc.

Truman Report Leaves Decision on Completing Canol to Army's Judgment

by Henry D. Ralph

Another vigorous defense of the Canol project was made promptly after the formal report by the Truman committee was released this week. The Army attitude on Canol indicates that the project will be completed despite criticism from members of Congress and the Petroleum Administration for War. Reports on testimony before the Truman committee were published in the December 2 and 23 Journals.

WASHINGTON, D. C.—A severely critical report on the War Department's Canol project was issued over the week end by the Truman committee of the Senate, which has been investigating this Northwest Canadian oil development for several months, but committee failed to recommend that it be dropped.

Noting that the Army has been rushing work on the project in recent weeks, the committee said that there might be nothing saved by dropping it now, and left to the Army the decision as to whether to abandon or complete it.

However, the committee did recommend that:

1. The contracts with Imperial Oil, Ltd., and the Canadian Government should be revised, if the project is continued, in order to protect post-war rights of the United States.

2. No more prospecting and development work should be done unless it is clear that some benefits will be obtained equal to the cost involved.

3. Authority over the entire program for obtaining petroleum, both from the United States and abroad, should be concentrated in the petroleum administrator for war.

"The committee is definitely of the opinion that the Canol project should not have been undertaken, and that it should have been abandoned when the difficulties were called to the attention of the War Department," the report stated.

War Department Excoriated

In reviewing the history of Canol, most of which was revealed at the committee's public hearings, the report was unsparing in its criticism of the War Department for adopting the project in haste and without adequate consultation with persons in position to know pertinent facts, and particularly for insisting on its continuance in the face of criticisms and objections from many quarters. Full blame was placed on Lt. Gen. Brehon Somervell, commanding general of the Army Service Forces, but his chief petroleum adviser, Brig. Gen. Walter B. Pyron, came in for considerable mention.

The report made no criticism whatever of the Canadian Government, Standard Oil Co. (New Jersey) or its Canadian affiliate, Imperial Oil, Ltd., Standard Oil Co. of California which was employed as consultant, or any of the contractors involved in the project. It stated that the conception of the project, the forms of the contracts and agreements, and the way in which the project was carried out were entirely the responsibility of the War Department.

In its summary of the history and description of the $134,000,000 oil project the committee made no mention of many relatively minor criticisms of Canol which were brought to light during the hearings or have been mentioned from other sources. The report concerns itself almost entirely with major considerations and matters of War Department operation and planning. For example, Canol was justified by the department as a matter of military strategy but the committee declares that it will produce only a fraction of the petroleum products needed to supply the Alaska Highway and the airports along it or for the defense of Alaska, and it should have been foreseen that it would have to be supplemented with other supplies in any event; the same amount of money, manpower and materials could have supplied far more oil in shorter time in that area; the volume of shipping required for Canol's construction would have supplied far more oil than it will produce, though its excuse was a shipping shortage; other agencies of the Government, including the Corps of Engineers and other experts within the War Department, could have foreseen Canol's shortcomings but their advice was not sought.

Some of the new information on Canol brought out in the report, together with some of the committee's comments on various phases of the project, follows:

As now constituted the Canol project, if completed, will cost approximately $134,000,000, not including the pay and maintenance of troops engaged in the work. This includes some $35,000,000 for dock facilities at Skagway, storage, a pipe line to Whitehorse, and distribution pipe lines along the Alaska Highway, which would have been needed in any event. The remaining $99,000,000 included $17,000,000 for prospecting and drilling at Norman Wells, $31,000,000 for a pipe line to Whitehorse; $24,000,000 to move the Bareco refinery from Corpus Christi, Tex., to Whitehorse; and $27,000,000 to construct overland and water transportation routes to get the equipment to Norman Wells.

Reserve Estimates Vary

Construction of that portion other than the products distribution system required transportation of 125,000 tons of material and supplies, the use of 65,000 tons of strategic materials, and the services of 4,000 soldiers and 12,000 civilians.

Through the expenditure of $8,014,400 to December 1, 1943, in exploration, Norman Wells field has been developed to a potential capacity of 7,500 bbl. per day if the wells are acidized. General Somervell estimated the reserve at 50,000,000 to 100,000,000 bbl., but Imperial Oil estimates it at 35,000,000 bbl. though part of it is considered unrecoverable because it is under the bed of the Mackenzie River.

General Pyron recommended a 4-in. pipe line. "He guessed wrong." Army engineers said 6-in. pipe was equally available, and its use would have permitted operation with 2 pumping stations instead of 12. Actually the engineers substituted 6-in. pipe for 100 miles at the western end, making possible the elimination of two pumping stations.

Installation of the refinery at Whitehorse required 7,787 tons of new steel in addition to the used equipment, though General Somervell had said the amount was insignificant. Only

5,000 tons of steel would be required to build a tanker with a capacity of 128,000 bbl. per trip, and four trips per year would supply as much oil as the refinery will produce. It will take the refinery 5 years to produce as much 100-octane gasoline as one tanker could take there is a year.

Instead of helping during 1942 and 1943 when shipping was at its low point, the project was a drain on available transportation facilities, to the detriment of the actual fighting forces in Alaska.

The cost of the pipe line laid on top the ground for 620 miles will be $31,017,579 to deliver 3,000 bbl. per day. The big-inch line, 24 in. in diameter, laid below the ground for 1,460 miles in the United States cost approximately $90,000,000 and will deliver 300,000 bbl. per day, "which emphasizes the admission that more oil could be obtained in the United States at less cost in materials and manpower."

The refinery to process 3,000 bbl. per day will cost $24,429,170. A 3,000-bbl. refinery, including a Houdry unit, first planned for Whitehorse but now dropped, could be built in California for $11,500,000.

Costs of operating the pipe line and refinery have not been accurately determined, but it is estimated that the operating cost alone will nearly equal the combined cost of purchasing an equivalent amount of finished oil products in California and transporting them to Skagway.

Two Prospects on Eastern Flank Of Anadarko Basin Showing Oil

by Carl Hoot

PROSPECTS of two important strikes on the east flank of the Anadarko basin, both in McClain County, Oklahoma, were encouraging last week when cores were recovered showing stains of oil. These tests are Carter Oil Co. 1 Cottingham in SE SW 4-7n-3w and the 1 Johnson ranch, SW NE 13-8n-4w.

Location of the two wells is thought to be on a separate trend from that outlined by West Moore and the Oklahoma City pools, and following the Nemaha Ridge around into Canadian County. It is interesting to note that this third circular trend is about the same distance from the newly established Noble, West Moore-West Edmond trend, as are the latter fields from the Moore, Oklahoma City and Britton trend.

Latest reports from the Cottingham well were that it had taken its third core of the second Wilcox sand, topped at 10,633 ft. The first core at 10,630-36 ft. recovered sandy dolomite, grading into a dolomitic sand carrying from a slight odor of gas to light oil staining and oil odor. The second core at 10,636-41 ft. recovered medium to coarse sand with good porosity and a good show of oil in the upper 4½ ft., with the bottom 6 in. a hard and tight sand with light oil stainings and good odor. The third core, at 10,641-45½ ft., recovered only 1½ ft., which carried some porosity; was dolomitic in character, fairly tight and hard, and had spotted oil staining. Orders were to core ahead.

Observers feel that the well has offered sufficient evidence to indicate that a producer of some sort can be expected. However, a discovery of major proportions will probably depend upon developments below the present depth. While the cores have had good shows of oil, the hard tight sand does not compare with the heavy saturated sand found in the Oklahoma City field.

The two Anadarko basin tests which have recovered oil-stained cores and their positions in relation to producing fields paralleling the Nemaha ridge

Northwest of the Cottingham well, Carter 1 Johnson ranch found Hunton lime at 9,500 ft. and the first core at 9,511-21 ft. recovered 1 ft. of fine to medium-coarse limestone, spotty oil-stained to bleeding oil bubbles, with fair porosity and slight odor. The second core from 9,521-26 ft. recovered 2½ ft. of tight crystalline limestone carrying some oil staining. The third core at 9,526-41 ft. recovered only 4 ft. of fairly porous crystalline limestone, with no shows and a drill-stem test had been ordered.

These two wells have spurred leasing in this general area and extending over into the Anadarko basin. Although Carter is well protected, owning nearly all the acreage surrounding the two tests, a number of major companies have assembled blocks to the north and south of the wells.

Permian Basin Oil Prices Adjusted by Texas Co.

Price adjustments announced by The Texas Co. on crude oil purchased in West Texas and Lea County, New Mexico, fields raises prices on high-gravity oils and lowers those on heavy grades produced in the Permian basin. The revised prices are effective as of 7 a.m. January 1.

The new posting starts at 70 cents a barrel for 20-gravity and below with a 2-cent differential upward for each degree of gravity to a top price of $1.12 a barrel for 40-gravity above.

The old schedule was 78 cents for 23-gravity and below, with a 2-cent differential to a top of $1.04 a barrel for 36-gravity and above.

Gasoline Sales to Federal Agencies Show Big Rise

AUSTIN, Tex.—November sales of tax-free gasoline to government agencies in Texas were 153,987,274 gal., contrasted with 103,031,954 gal. sold to taxpaying customers, figures released by the state comptroller's office show. Government sales in November 1942, when rationing had not gone into effect, totaled only 30,603,526 gal.

Tax collections on November 1943 gallonage were $4,240,818, compared with $5,888,707 paid a year earlier on gasoline bought in the last month before rationing began. December 1943 tax collections on November sales were $222,000 above those for October sales.

World Oil Policy Inducive to Peace Sought by Jersey Company

NEW YORK.—An international oil policy which, it is said, "will secure adequate petroleum reserves to meet the future needs of our own nation and of other nations more certainly and more rapidly than any alternative procedure" is outlined in the current issue of the Lamp, publication of Standard Oil Co. (New Jersey).

The magazine holds that "no more effective contribution to future world peace is likely to be devised.

"The world suffers today from the lack of an enlightened comprehensive policy with respect to the earth's resources of oil," the Lamp states. "We are confronted with an acute and growing need for oil, not only for military activity in war but for economic and social advances in peace. The oil fields of the United States, which have supplied more than 60 per cent of the world's oil in the past, cannot be relied upon to maintain this record in the future. Our own peacetime demand already approaches, if it does not exceed, our capacity to produce oil efficiently.

"But the rest of the world needs oil as badly as we do. . . . Standards of living can rise only as they are supported by cheap transportation. And today cheap transportation exists only on a basis of cheap oil.

"The development of adequate sources of supply of oil for the world is an indispensable preliminary to the establishment of high standards of living over the world. Once developed, the oil resources of the earth can be made the foundation on which to erect high standards of living in other nations just as our own oil resources have been made the basis of our own high living standard.

"The responsibility for devising and establishing an enlightened world oil policy rests on the United Nations. . . .

"The situation is wholly analogous to that of the United States itself, where, under the conservation laws of the several oil-producing states and the covenants of the Interstate Oil Compact, with the approval of Congress, national demand for oil is supplied through ratable withdrawals from fields of the several states up to the optimum rate of each field as a limit. . . .

"In the search for oil and the development of the oil resources of the earth, Americans can render society at large an outstanding service. The world's oil industry is practically an American industry; its methods, its equipment and much of its personnel is American. Without a strenuous effort that utilizes efficiently American staff and methods it is doubtful if the world's oil resources can be developed fully for a long time to come. . . .

"In a free international economy the distribution of exportable surplusses to consuming nations will respond flexibly to demand. The exporting nation will determine for herself in every case the volume of her exportable surplus, having first provided for her internal demand. . . . Among the principal barriers that obstruct the path of an enlightened world oil policy are the state monopolies by which some nations reserve to a government agency all activities relating to oil, denying to private citizens any part in the oil industry. . .

"Import duties on oil or oil products handicap the internal economy of any nation which is not self-sufficient in oil. Heavy special taxes on oil products make impossible their wide use and deny the benefits of cheap fuel to the common man, thus forcing him to lower his standard of living. Distribution controls, either by the state or the industry, which establish production quotas or market quotas, and fix prices at high levels, are destructive of both free enterprise and high living standards.

"Our Government can contribute to the formulation and establishment of an enlightened world policy for oil by assuming leadership, in concert with Great Britain, in devising an acceptable policy and in persuading other nations to agree and to adhere to its provisions.

"Our Government can also lend active diplomatic support to American citizens and other nationals who seek through legitimate methods to negotiate, explore and develop oil concessions throughout the world, to produce and distribute oil and oil products in free enterprise."

The magazine listed assurances which Americans seek from a foreign government: Security of title, managerial control and opportunity to make a reasonable profit.

It also listed points upon which a foreign government will properly insist: Adequate participation in proceeds; contribution to the domestic economy; satisfaction of domestic demands before exportation; prevention of avoidable waste; giving local citizens maximum training and employment at fair compensation; the movement of exportable surpluses to market in fair volume and at fair prices.

The American Government, the Lamp said, would wish to assure itself that: American citizens are accorded rights to which they are entitled; they meet their obligations to foreign governments; operations are conducted in the best interests of the United States; principles of conservation are adhered to; exportable surpluses move efficiently, orderly and at fair prices; imports into the United States be regulated to serve our best interests domestically, including our domestic oil industry. These imports should not work a hardship on our oil industry or stifle oil finding and should be admitted only to supply demands that cannot be met without production in excess of optimum rates.

OPA Raises Ceiling Prices For Crude in Three States

WASHINGTON, D. C.— Upward adjustments in ceiling prices for crude oil in certain fields of Arkansas, Louisiana, and Michigan were announced by Office of Price Administration last week because existing ceilings were out of line with prices of comparable crudes in the same areas or because operations were being conducted at a loss. The increases, ranging from 2 to 15 cents a barrel, were granted after petitions for a review of prices had been filed.

In Smackover field, Arkansas, the new ceiling is a flat 98 cents per barrel, an increase of 15 cents.

In certain designated fields in Louisiana the new ceiling for 40-gravity and above is $1.30 with the customary differentials for lower gravity crudes. This creates the following maximum prices: Bayou Des Allemands and Raceland fields, for 36.5-gravity, the grade produced in this area, $1.22, an increase of 13 cents; Gibson field, where oil averages 37 to 37.9 degrees $1.24 an increase of 5 cents; Lake Arthur and North Tepetate fields where oil averages well over 40 degrees, $1.30, an increase of 12 cents; Tepetate field, 35.6 degrees, $1.20, an increase of 2 cents; Abbeville field, over 40-gravity, $1.30, an increase of 13 cents.

In Headquarters field, Michigan, the new ceiling is $1.48, an increase of 9 cents.

WPB Regional Offices Assigned More Authority

WASHINGTON, D. C.—Regional offices of the War Production Board are now authorized to process construction applications, with certain exceptions, if the cost of the project is less than $25,000, the WPB Facilities Bureau announced last week.

FOUNDED IN 1910

BY PATRICK C. BOYLE

the OIL AND GAS JOURNAL

Keeping Pace With Refiners

THOSE in closest touch with conditions are concerned as to whether the petroleum industry generally, the war agencies and the military, have a realistic conception of the task ahead for refiners during the year just starting.

They are fearful that in the critical months to come the proverbial straw that broke the camel's back will arrive and the war effort, too late, will wake up to the fact that more has been asked of the manufacturing branches of the oil industry than they could accomplish under the existing governmental restrictions.

Few have attempted to interpret what the routine Washington announcements regarding butadiene, 100-octane fuel and other petroleum war products, mean to refinery managements. For example, there was the PAW explanation of the past week that the engineering plans for 22 additional 100-octane plants were being completed. These must be built this year and added to the refineries now contributing to the production of this superior fuel and to plants under construction.

A large part of this aviation-gasoline activity is located in refining centers which are also producing synthetic rubber ingredients, the finished rubber, and many other of the emergency requirements. The skilled manpower situation in these areas and in many of the less concentrated centers is becoming more acute due in part to the manner in which the Selective Service Act and other governmental regulations are being enforced.

Processing methods are new to those who have had years of refinery experience. Thousands who had never previously been inside a refinery gate are being trained to operate equipment which, in the case of 100-octane alone, is to cost nearly a billion dollars.

Only plant managers and operators who are on the job around the clock, every day of the year, know the problems that have been theirs in adding this mammoth war machine to their peacetime activities. Processing has been complicated in many instances because of the necessity of operating with new domestic and imported crude oils, including greater quantities of sour crudes. Product yields have been changed and further revisions will be necessary.

Every problem, with the exception of some phases of transportation which the refiner has had over the past 2 years, will become more acute this year. Most operations are to be expanded throughout 1944. Further dislocations in refinery procedure are inevitable. The wear and tear on prewar facilities, which have been overworked and overlooked in the rush to build war plants, are certain to be felt. Crude-oil prices have been advanced in several areas with no offsetting adjustments in prices for refinery products.

To assume that existing and oncoming problems of the industry's manufacturers will take care of themselves threatens the success of the remaining war effort. Materials shortages can be relieved if the Washington agencies take the needed action. New construction, not directly connected with war production but mandatory to round out facilities at many plants, should be encouraged. A well-directed program under the supervision of refiners will ease the manpower situation. The incentive of greater returns to offset higher costs is needed. Crude-oil shortages at many plants can be relieved through proper handling of transportation.

These are today's problems, not tomorrow's, and what is accomplished in the first quarter will largely determine the course of the entire year.

Twenty-Three Refiners to Share 64,690 Bbl. of Crude Oil Daily

CHICAGO.—Twenty-three oil companies are scheduled to supply 64,690 bbl. of crude oil daily in January to other refiners in District 2 to alleviate the shortages of petroleum as far as possible under the government-industry crude-sharing plan. Oil involved in the January schedule represents an increase of 10,650 bbl. over the transfers prevailing in December.

Standard Oil Co. of New Jersey and its affiliated companies will supply 20,000 bbl. daily of the total and Sinclair Refining Co. will furnish 11,660 bbl. daily. Gulf Oil Corp. will turn over 4,065 bbl. daily to four refiners and Standard Oil Co. (Ohio) is to supply 5,500 bbl. daily to six plants. Details of the January schedule are shown in the accompanying table.

Supplying companies—	Receiving companies—	—Bbl. day—	
Aetna Oil Co.	Louisville Refining Co.	....	1,750
Allied Oil Co.	Petroleum Specialties, Inc.	....	1,000
Ashland Oil & Refining Co.	National Refining Co.	....	500
Bay Refining Co.	Marvel Refining Co.	....	400
Cities Service Oil Co.	Eldorado Refining Co.	....	1,500
Deep Rock Oil Corp.	Eldorado Refining Co.	700	
	Midland Cooperative Assn.	200	900
Gulf Oil Corp.	Arrow Petroleum Co.	1,365	....
	Champlin Refining Co.	1,500	....
	Louisville Refining Co.	500	....
	Naph-Sol Refining Co.	700	4,065
Indiana Farm Bureau	Louisville Refining Co.	....	600
National Co-Op Refinery	National Refining Co.	....	500
Ohio Oil Co.	National Refining Co.	....	2,300
Phillips Petroleum Co.	Bay (McPherson)	200	....
	Derby Oil Co.	1,100	....
	Kanotex Refining Co.	700	2,000
Pure Oil Co.	Midwest Refining, Inc.	200	....
	Rock Island Inds.	2,000	2,200
Roosevelt Oil Co.	Midwest Refining, Inc.	425	....
Shell Oil Co., Inc.	Globe Oil Refining Co.	....	1,500
Simrall Corp.	Crystal Refining Co.	600	....
	Lakeside Refining Co.	540	....
	Marvel Refining Co.	350	....
	Midwest Refining Co.	425	....
	Old Dutch	900	2,81[illegible]
Sinclair Refining Co.	Sun Oil Co.	9,000	....
	Worth Refining Co.	2,660	11,660
Skelly Oil Co.	Eldorado Refining Co.	....	1,800
Socony-Vacuum (Detroit)	Naph-Shell Refining Co.	....	300
Socony-Vacuum (East St. Louis)	Globe Oil Refining Co.	....	350
Standard Oil Co. (Indiana)	Bay (McPherson)	500	....
	Derby Oil Co.	500	1,000
Standard Oil Co. (Ohio)	Advance Refining Co.	1,150	....
	Cascade Refining Co.	300	....
	National Refining Co.	1,200	....
	Pana Refining Co.	250	....
	Rock Island Inds.	1,000	....
	Stoll Oil & Refining Co.	1,000	5,500
Standard Oil Co. of New Jersey	Allied St. Elmo	1,200	....
	Globe Oil Refining Co.	9,500	....
	National Refining Co.	4,800	....
	National Co-Op Ref.	1,500	....
	Sun Oil Co.	3,000	20,000
The Texas Co.	Johnson Oil (Gary)	....	1,200
	Total	....	64,690

Court Upholds FPC in Gas-Rate Case

WASHINGTON, D. C.—Federal Power Commission was upheld by Supreme Court in commission's action against Hope Natural Gas Co. concerning the company's rate, the Fifth Circuit Court of Appeals being reversed in a divided opinion. The suit involved differing theories regarding property valuation for rate-making purposes. Justice Douglas delivered the majority finding. Separate dissents were read by Justices Frankfurter, Reed, and Jackson.

Justice Douglas made no particular distinction between rate-making theories and did not indicate a preference for one over another. In upholding the commission action, which reduces the company's earnings by $3.6 million a year, he repeated the expression in an earlier court opinion that the commission is "not bound to the use of any single formula or combination of formulae in determining rates."

"It is not theory, but the impact of the rate order which counts," the justice said. "If the total effect of the rate order cannot be said to be unjust and unreasonable, judicial inquiring under the act is at an end.

"The fact that the method employed to reach that result may contain infirmities is not then important. Moreover, the commission's order does not become suspect by reason of the fact that it is challenged. It is the product of expert judgment which carries a presumption of validity.

"* * * Nor is it important to this case to determine the various permissible ways in which any rate base on which a return is computed might be arrived at. For we are of the view that the end result in this case cannot be condemned under the act as unjust and unreasonable from the investor or company viewpoint."

Commission Fixed Rate

The court noted that the commission fixed a rate which would permit annual earnings of $2,191,314 and in doing so had stressed the importance of maintaining the company's financial integrity. It said the company was a "seasoned enterprise" having markets in populous areas and a supply situated nearby.

"In view of these considerations," the opinion went on, "we cannot say that an annual return of $2,191,314 is not 'just and reasonable' within the meaning of the act. Rates which enable the company to operate successfully, to maintain its financial integrity, to attract capital and to compensate its investors for the risks assumed certainly cannot be condemned as invalid, even though they might produce only a meager return on the so-called 'fair value' rate base."

Standard of California Receives Mexican Payment

WASHINGTON, D. C.—Standard Oil Co. of California last week received a check for $1,913,997.59, representing first payment on a settlement for its interest in Mexican oil properties expropriated by that government in 1938.

The total settlement with Standard of California amounts to $3,589,158 plus 3 per cent interest from the date of expropriation. The balance of this sum is payable in four annual installments, the last of which will be due in September, 1947.

The amount payable to Standard of California was agreed upon by the United States and Mexican governments last September. At that time the two governments also agreed upon settlements of similar claims by other American oil companies.

Rate of Withdrawal Held Most Important Factor in Ultimate Recovery of Oil

Results of 4-Year Engineering Study

THE rate at which oil is withdrawn from its reservoir has an important bearing on the probable ultimate recovery from a particular field. This is one of the most significant conclusions reached in a report released last week by engineers of producing affiliates of Standard Oil Co. (New Jersey) and of Humble Oil & Refining Co.

The study of the behavior of petroleum in reservoirs is the result of a 4-year research project conducted by petroleum engineering staffs of the Jersey company's producing affiliates and published in a 77-page report by Standard Oil Development Co. M. L. Haider, New York, was chairman of the Standard of New Jersey engineers assigned to the project and Carl E. Reistle, Jr., Houston, Tex., was chairman of the Humble company's group.

Careful control of well pressure and other operating factors is essential, the report holds, in recovering the maximum volume of petroleum from a reservoir. On the other hand, the group concluded, the number of wells or the distance between them has little practical effect in the long run on the total amount of oil that could be brought to the surface, provided the rate of withdrawal of oil from the pool as a whole and from the various portions thereof is properly controlled.

The committees' studies indicated, the report asserts, that the well spacing employed in most old and in some new fields has been much closer than necessary or desirable from an economic standpoint.

Studies upon which the report is based correlates laboratory research with actual field experience on two continents. Pools with widely varying geological characteristics and operating conditions were studied in Texas, Oklahoma, Louisiana and Arkansas, as well as Venezuela, Colombia, Peru and Argentina.

Three types of underground energy were studied and the relative efficiency of each estimated in its effect on ultimate recovery of oil from the field.

1. **Dissolved-gas drive.** — This involves using the energy of the gas already dissolved in the oil as it exists in the ground. While useful in conjunction with other forms of underground energy, the engineers found only 20 to 40 per cent recovery of oil could be obtained through the use of dissolved-gas drive alone.

2. **Gas-cap drive.**—A gas cap exerts a downward pressure on the oil, forcing it through the strata to wells which are, in this case, completed in the oil zone. Gas-cap drive is 50 to 100 per cent more efficient than the dissolved-gas drive. Under the proper conditions as much as 80 per cent of the oil in a particular pool can be recovered by this method. Moreover, where a gas cap does not exist naturally, engineers can often create one by the injection of gas under pressure at the crest of the underground structure.

3. **Water drive.** — Water drive has the advantage over the gas drives of very effective cleansing of the oil from the pores of the rock. The engineers whose studies are compiled in this survey believe water drive to be the most effective of the three forms of natural energy found in the underground reservoirs. In most fields from 60 to 80 per cent of the oil in place can be recovered through the efficient use of water drive.

In certain Gulf Coast fields currently utilizing water drive to a high degree, it was found that initial oil withdrawals of about 3 to 5 per cent per year of ultimate yield permit efficient high-pressure water displacement.

The optimum spacing for a field, the committees concluded, becomes essentially an economic problem. Of considerable importance, however, is proper well location to insure drainage of lenses and fault blocks, and to provide control of movement of gas and water in the sand. There is no limit to the distance to which a drainage radius may extend in continuous sand, the committees observed, time alone determining the distance reached at any instant in the depletion period. Thus, they continued, there is no fixed or limited drainage radius and the effect of many wells, rather than few, is essentially one of accelerated depletion owing to early intersection of the expanding zones of influence of the wells.

Economics may largely decide the optimum well spacing, it was conceded. For example, it may be found

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from study of a reservoir that a certain wide spacing would, under existing reservoir and well-operating conditions, require excessive time for depletion. The operator would have to weigh the cost of closer spacing, hence higher investment, against whatever advantage would accrue from the lesser depletion time obtainable by closer spacing.

The supposed relationship between spacing and recovery, the study groups contend, has now been found to be due solely to normal regional drainage within the reservoir, induced simply by the creation of low-pressure areas under the leases having the most wells; the result was a widespread influx of oil from adjoining portions of the reservoir but without change in recovery from the reservoir as a whole.

The theory that more energy is required to move fluids over greater distances and hence result in lower ultimate oil recovery in fields where wide spacing prevails was entirely discounted by the Jersey company engineers. In radial flow, it is held, the velocity of the fluid decreases very rapidly with distance from the well, and the energy required to move a particle of oil to the well from 2,000 ft. is only negligibly greater than that required to move oil to the well from 500 ft.

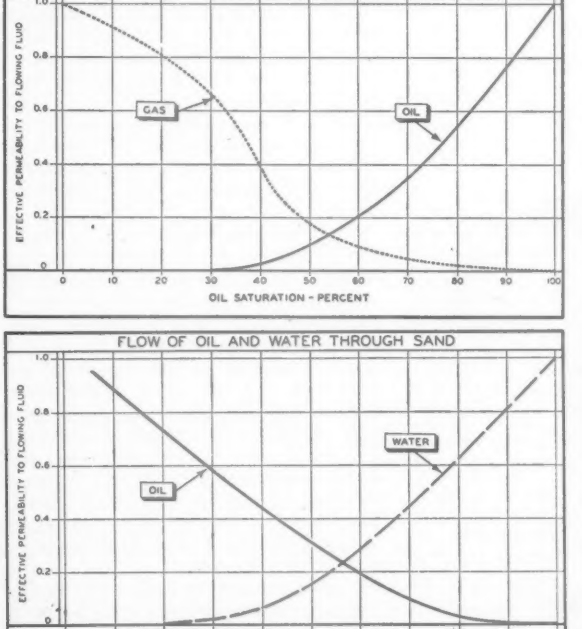
In practically all commercial reservoirs, it is asserted, the gas dissolved in oil has an energy equivalent far greater than that which could possibly be used in moving oil to a well. The minor changes in energy consumption with distance from a well will have no appreciable effect upon oil flow where a superabundance of energy is available from gas in solution. Furthermore, in the gas-displacement and water-drive mechanisms the supplementary sources of energy also aid in moving oil through the sands; hence, the matter of energy consumption in oil drainage may normally be regarded as of negligible importance.

The entire chapter on "Data Required for Reservoir Studies" is reproduced below because of the increasing interest in this phase of petroleum engineering.

Data Required for Reservoir Studies

As one result of their studies, the committees found it highly desirable that the securing and recording of reservoir information be maintained in all fields on a scale sufficiently adequate to permit its intelligent interpretation and application in the analysis of reservoir behavior.

In weighing the expense and effort entailed in obtaining dependable reservoir information, it must be borne in mind that pool studies are not merely projects of academic interest but are, in effect, reserve estimates that have reduced to a minimum the assumptions and extrapolations generally accepted as an integral part of reserve estimation. Pool studies not only yield better estimates of oil in place but also enable more accurate estimation of possible percentage of reservoir oil to be recovered by the recovery mechanisms which may be operative under various exploitation programs. As in any other study, dependable analysis of reservoir behavior requires that the information be broad enough to reduce or eliminate assumptions and, just as important, that the information be as accurate as available methods and equipment permit. All information, irrespective of its volume or accuracy, has certain limitations, as do the mathematical tools with which some of the data are analyzed; consequently, the analyst must also have full understanding of both his data and tools if dependable results are to be obtained. The cost of obtaining and applying reservoir information must be weighed against the value of more dependable reserve estimates and more efficient operating programs and not against an intangible or imagined value that might accrue from an academic study.



Typical effective permeability versus saturation relationships for gas-oil and water-oil systems

In general, the information required for dependable analysis of a reservoir falls into four broad groups:

(a) Characteristics of reservoir structure.

(b) Characteristics of reservoir fluids.

(c) Pressures and temperatures.

(d) Statistical data on exploitation operations.

All of these are needed to present a reasonably complete picture to the analyst, and the use and interpretation of one is usually dependent on the others. The major features of these groups, as regards their bearing on pool studies, are as follows:

Characteristics of Reservoir Structure

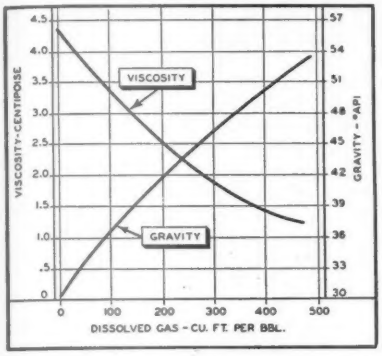
The general function of this information is to provide a picture of the reservoir itself, assuming that "reservoir" in this sense includes the total continuous extent of sand accumulation without regard to the fact that large portions of the sand may contain only gas and water.

Considerable effort should be made to obtain a clear understanding of the regional geology to determine the relation between it and the oil reservoir proper, especially as regards outcrop of reservoir sands, extent of the underlying water sheet, and to recognize the presence of folding, faulting, changes in sedimentation and other geologic features which may have an important effect on the behavior of the oil reservoir.

Evaluation of the oil reservoir must begin with the determination of the volume of oil-bearing sand. In determining sand thickness, electric logs, coring, cutting samples, and driller's logs should all be considered to insure the most accurate estimate. It is also important to distinguish between over-all and net sand thickness, the latter preferably being clean and permeable sand as contrasted with shales and sandy shale which may yield very little oil and, when included in sand-thickness figures lead to appreciable errors in reserve estimation and studies of recovery efficiency. It is strongly recommended that adequate coring programs supplement electric logging. The areal extent of the oil reservoir can be determined definitely only by drilling, and it is of great importance that the drilling program be designed so as to outline the productive limits as soon as possible after active exploitation of the field is started.

The cores obtained should be subjected to complete analysis, including

porosity and permeability, saturations of oil, gas and water, and chlorides content. Samples of formation water should be analyzed for aid in determination of original connate water content. A well-balanced coring program will give the operator, through the results of complete core analyses, a fair idea of the character of the sand and its fluid saturation and may, therefore, have an important bearing on such operations as



Change in viscosity and gravity of crude oil due to dissolved gas

gas injection, water flooding, acid treatment and other field developments. It is important to note variations in sand characteristics, such as alternate tight and permeable streaks and changes in saturation, for their influence on depletion estimates and on various aspects of the control of fluid movement in the sand.

Characteristics of Reservoir Fluids

This group covers the nature of reservoir fluids — the flash and differential liberation of dissolved gas, oil shrinkage, viscosity of reservoir oil, and complete hydrocarbon analyses on the reservoir oil and analyses of samples of the gas in free gas caps. These data are necessary for the prediction of future behavior of the oil body and are required for any real understanding of a field's behavior, regardless of the approach employed in the study. To obtain these data it is essential that samples of reservoir fluids be obtained and analyzed before the depletion of a reservoir has proceeded to any great extent. The samples should be taken from early wells so distributed as to locate regional variations before substantial quantities of oil are produced.

It is usually difficult to estimate the original fluid characteristics accurately from samples obtained after considerable pressure decline, and data on the nature of the original fluid may be extremely valuable in checking behavior trends throughout the reservoir. Because seriously misleading conclusions may be drawn from inaccurate subsurface sample analyses, it is essential that all precautions be taken to insure the obtaining of truly representative samples. This may often be possible only by careful consideration of well conditions and checks against other sample data. Following the original determinations, samples of reservoir fluid should be obtained periodically during a field's life for checking on reservoir behavior.

Pressures and Temperatures

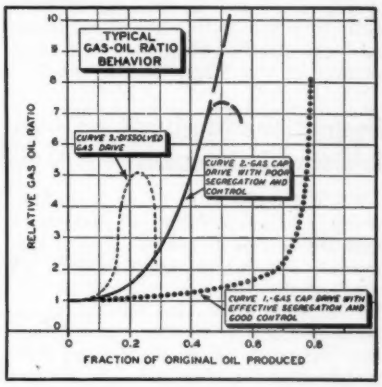
Original reservoir pressure and temperature should be obtained as early as possible, preferably from tests in the initial wells immediately after completion. As development proceeds, a routine should be established for pressure surveys at suitable intervals to evaluate recovery efficiency and its control. The interval between surveys should not exceed 12 months in any field and where conditions are known to be changing rapidly or where major changes in operating practices are introduced, surveys should be made more frequently, at intervals best adapted to the particular field. As in the case of samples of reservoir fluids, it is important that reservoir and well conditions be considered before interpreting subsurface pressure measurements, so as to insure the greatest possible accuracy in their use.

In the development of a field, dry holes are frequently drilled on the edge of production or, in some cases, a considerable distance from production. Subsurface pressure measurements in such wells are valuable and should be obtained at every opportunity as they indicate the potentialities of a water drive. Subsurface pressures should also be taken periodically in closed-in wells, as such data are useful in studying the effectiveness of the well spacing, regional drainage, and degree of depletion at points remote from the wells.

Aside from the measurement of static pressure in wells for the determination of reservoir pressures, such studies as flow and interference tests should be carried out to establish the general nature of the wells' performance characteristics. Flow tests for productivity factor determination should be made on at least 10 to 15 per cent of the wells and, if feasible, on each well immediately upon completion. Periodic retests during a well's life also provide useful information. These data, in addition to aiding efficient production of wells, also indicate changes in conditions around the well bore.

Statistical Data

No less important than the technical data on the reservoir are the statistical data on operations, such as records of oil, gas, and water production and well-completion reports, together with changes required in the reports as the result of workovers or other mechanical repairs and changes. There has been, in the past, a tendency in many areas to neglect data on water and gas production, and sufficient care is not always exercised in test procedure. Consequently, reported gas-oil ratios and water percentages are often misleading. In the final analysis interpretation of technical data obviously can be no better than the accuracy of the statistical data. The bulk of statistical data regarding production and, to a lesser


TYPICAL GAS-OIL RATIO BEHAVIOR
RELATIVE GAS OIL RATIO
CURVE 3.-DISSOLVED GAS DRIVE
CURVE 2.-GAS CAP DRIVE WITH POOR SEGREGATION AND CONTROL
CURVE 1.-GAS CAP DRIVE WITH EFFECTIVE SEGREGATION AND GOOD CONTROL
FRACTION OF ORIGINAL OIL PRODUCED

The typical gas-oil ratio trends under gas-cap drive at three rates of efficiency and under dissolved-gas drive

degree, data on the mechanical status of wells have to be compiled for use in other than strictly operational studies but are not always tabulated in the form best adapted to reservoir study work. Some duplication is necessary, therefore, since it is desirable that the reservoir analyst have his statistical data so assembled in charts and tabulations that a ready record of production, pressure decline, and the various trends is available. Sources of error should be eliminated and proper distribution of responsibility should be enforced.

Certain information must be obtained as early as possible, and it must be accurate. Data on original conditions, required for practically all studies, cannot always be estimated satisfactorily after depletion has advanced. They must be obtained at an early stage and should be considered as much a part of well completion as the initial gage. Accuracy of information is stressed to avoid the tendency to overlook the importance of dependable information and the resultant failure to exercise requisite care in securing and recording information. Considering that the cost of obtaining and recording complete information on wells and their performance is a very small part of drilling and producing expense, careful compilation of all pertinent data is very low cost insurance that operation of the reservoir will be as efficient as possible under the general economic conditions prevailing during its producing life.

J. B. Stoddard, Independent Operator, Buys Circle Oil

DALLAS, Tex.—Acquisition of Circle Oil Co., of Houston, Tex., with its 52 wells in Texas, Oklahoma, and Louisiana, by J. B. Stoddard, independent operator of this city, was announced by him last week. Reported consideration was $1,500,000 cash. The properties involved have an estimated reserve of 4,000,000 bbl. of oil. Stoddard is drilling wildcat wells in Starr and Colorado counties, one test in the Willamar field and another in the Magnolia City pool.

Restrictions Modified on Pressure Lubricants

WASHINGTON, D. C. — Manufacturers and distributors of extreme-pressure lubricants are relieved of the necessity of maintaining records of sales of the product to civilians as the result of a partial revocation of Recommendation 40, an action taken here last week by the Petroleum Administration for War.

Restrictions are now lifted on the manufacture and sale of extreme-pressure lubricants. They had been in force since April 20, 1942, limiting manufacture and sale to not more than 75 per cent of production during 1942.

The requirement originally had been intended to overcome a shortage of critical chemicals used in the manufacture of additives for extreme-pressure lubricants. Of recent weeks the supply of additives has become more than adequate for all requirements.

Not Now a Holding Company Standard Reports to SEC

PHILADELPHIA, Pa. — Standard Oil Co. of New Jersey has applied to Securities and Exchange Commission for an order declaring the company is no longer a holding company, and the commission has named January 21 as the date for a hearing on the application.

Standard states that it has transferred to Consolidated Natural Gas Co. all its holding in four gas utility subsidiaries (Hope Natural Gas Co., East Ohio Gas Co., Peoples Natural Gas Co., and River Gas Co.), in addition to the stock of New York State Gas Corp., a nonutility pipe-line subsidiary.

Midstates Sells East Texas Production to Tide Water

Midstates Oil Corp., Tulsa, has sold 58 wells on six producing leases in the East Texas field to Tide Water Associated Oil Co. for $2,500,000 cash.

"While our East Texas wells were well located and constitute a rich future reserve," said N. T. Gilbert, secretary and general manager of Midstates, "we consented to sell them because we could use the cash in furthering our operations in the Haynesville district of northwestern Louisiana."

As the daily allowable is 20 bbl. per day, 20 days a month, the production sold to Tide Water averaged 1,160 bbl. a day, or 23,200 bbl. monthly.

Midstates has 48 completed wells in Haynesville and has work planned for perhaps as many more wells there.

DEATHS

George Gilmore Walters, 65, drilling contractor, died January 2 in Bradford, Pa.

Iceman F. Platt, 78, oil-field worker and drilling contractor, died January 1 in Oil City, Pa.

Walter P. Moore, 67, oil man, banker, cattle man, and civic leader, died at his home in Tyler, Tex., January 5. He had extensive oil holdings and had been active in their operation since discovery of the East Texas field. During the "hot oil" days he served on the "Little Railroad Commission."

Claude Bailey, 46, statistician in the comptroller's office of The Texas Co., Houston, Tex., and before that traveling auditor for the company, died January 3 at his home in Houston. He was a graduate of University of Texas.

John Fletcher Dudding, 49, superintendent of Feazel Oil & Gas Co., died last week in Shreveport, La.

Henry P. Bolt, for many years Indiana and Michigan representative of Bodie-Hoover Petroleum Co., died January 2 in Chicago.

John M. Meeks, for many years representative of National Supply Co. in Illinois, Oklahoma, and Kansas, died January 3 in Topeka, Kans.

Frederick W. Knupp, 76, who passed his adult life working in the oil fields of Pennsylvania, Ohio, and other oil states, died December 22, at his home in Duhring, Pa.

John F. Cornelius, 50, for 20 years a pipefitter for Manufacturers Gas Co., died December 27 at his home in Bradford, Pa.

Nelson M. Turner, 85, retired oil man, died January 1 in a convalescent home in Tulsa.

A. T. Smith, 57, in charge of the Fort Myers, Fla., sales office of Sinclair Refining Co., died December 30. Smith was sales manager for the old Producers & Refiners Corp. in Denver, Colo.; Independence, Kans., and later Tulsa, and when Sinclair took over Parco he continued with Sinclair.

J. Clarence Moore, 65, drilling contractor in various fields of United States, besides spending several years in Russia and India, died December 27 in Long Leach, Calif.

Walter H. Parker, 51, vice president in charge of manufacturing, Pittsburgh Equitable Meter Co., Pittsburgh, Pa., died suddenly at his home in that city December 28, from a heart attack, following contraction of pneumonia. Prior to becoming connected with the Pittsburgh firm, in 1929, he was chief engineer for Fry Equipment Co., Rochester, N. Y. He served as a captain in the Air Corps during World War I.

James Albert Cree, 71, who learned the oil-field machinist's trade in the shop of the old Bettman-Watson Oil Co., Belmont, W. Va., and later owned or was interested in oil and gas-field repair shops in Ohio, West Virginia, Michigan, Kansas, and Texas, died recently at his home in Utica, Ohio.

Ida Minerva Tarbell, 86, who gained prominence early in the century through her "History of the Standard Oil Co.," died of pneumonia January 6 in a hospital in Bridgeport, Conn. She had resided with a sister in Easton, near Bridgeport. Miss Tarbell's analysis of John D. Rockefeller and of the old Standard, dissolved in 1911, was severely denunciatory, and her accusations elicited a sweeping reply. Her early reputation as a "trust buster" faded, and it was said of her that she developed a sense of fairness, especially revealed in her "Life of Judge Gary," which was highly commendatory of the head of United States Steel. Her fame as a biographer was earned largely through her studies of Abraham Lincoln. She was born on a farm in Erie County, Pennsylvania. Following the Drake oil discovery the family moved to Rouseville, Pa., and her father was the first manufacturer of wooden tanks for oil.

C. S. Thorp, 57, oil producer in Rogers and Nowata counties, Oklahoma, died January 10 in Claremore, Okla.

James H. Tucker, 65, for years a representative of National Supply Co., died January 8 in Houston, Tex.

Thomas Clark Burns, 89, formerly an oil producer of North Washington, Pa., died December 29 in Grove City, Pa., where he had resided since the death of his wife in 1939.

RADIATION—The New Petroleum Analytical Tool

*by C. H. Schlesman and F. P. Hochgesang**

The use of the electromagnetic spectrum as an analytical tool in petroleum refining has spread rapidly in the last 2 or 3 years. One main advantage is the speed of determinations of the main constituents of an operating stream or other sample, making possible the exacting control necessary for our newest refining processes. This article discusses the uses and limitations of X-ray and electron diffraction, mass spectroscopy, emission spectrography, Raman, ultraviolet and infrared spectrography as applied to hydrocarbon analysis.

IN years past conventional methods of analysis served for the control of petroleum products. Gravity, viscosity, boiling range and a few wet chemical analyses were quite adequate during World War 1. These simple methods are not adequate, however, for controlling the manufacture of modern petroleum products such as high-octane gasoline, all-purpose motor oils and the numerous pure compounds produced from petroleum for rubber and resin manufacture. These new processes of our refineries created at the same time, demands for speedier and more explicit analytical information. Indeed, many of the modern research developments might have been impossible had not the new analytical methods been available.

Some half dozen years ago at Socony-Vacuum's research and development division at Paulsboro, N. J., a radiation laboratory was formed which has grown to operate in nearly all regions of the electromagnetic spectrum. The methods of analysis employed were, until a few years ago, scientific curiosities limited to operation at the hands of specialists in university laboratories. Now equipment design has been so improved and made so rugged that routine analyses may be made rapidly by relatively inexperienced operators.

The Electromagnetic Spectrum

Radiant energy belongs to the electromagnetic spectrum. This spectrum is shown schematically in Fig. 1. Some portions of it are familiar to everyone. Note that visible light and the radio broadcasting band occupy relatively narrow portions of the spectrum. Sixty-cycle alternating is found at the extremely low frequency end of this so-called spectrum. The electrical or insulating properties of oils and waxes makes them useful as dielectrics. Their properties in this region of the spectrum have been known for many years and are of importance to the manufacturer of electric equipment.

At the other end of the spectrum, the high-frequency or short wavelength end, gamma rays and short X-rays are fairly familiar because of their use in radiography. Doctors set broken bones and engineers inspect welds and castings with the aid of this radiation. In the past 2 or 3 years gamma rays have been used to log wells and determine where oil-bearing strata might be even though metal casing has already been set within the well. With the advent of the cyclotron and similar atom smashers, nuclear rays have been used in numerous novel experiments involving radioactive "tracers." Atoms of a specific element can be "tagged" by making them artificially radioactive and then followed throughout the course of a reaction by measuring this radioactivity.

The X-ray, ultraviolet, visible and infrared regions of the spectrum are those which find the greatest use in the radiation methods of analysis which have become so useful in petroleum research. A few general statements will serve to illustrate the principles involved. The methods are primarily those of the physicist, not the chemist. The chemist endeavors to make materials react with specific reagents to yield a unique product which will identify some component of the original sample and which can preferably be weighed or titrated to determine the concentration of the unknown component in the sample. The physicist on the other hand usually makes measurements on the sample as received, often returning the sample still in the "as received" condition. Such physical measurements yield new and direct information concerning the sample. Such methods are frequently much more rapid than wet methods and only a small amount of sample (sometimes less than a milligram) is needed for a complete analysis. Continuously recording equipment operating from plant streams is often practicable. However, such equipment may often be quite complex and expensive in first cost.

X-Ray Diffraction

X-ray diffraction was the first of the modern radiation methods to be installed in the Socony-Vacuum laboratories. Such equipment provides a means for the unique identification of crystalline materials. Just as a human fingerprint serves to identify a particular person, an X-ray diffraction pattern is a "fingerprint" of a crystalline material. This is possible because the distance between the "atomic building blocks" in crystalline materials is of the same order

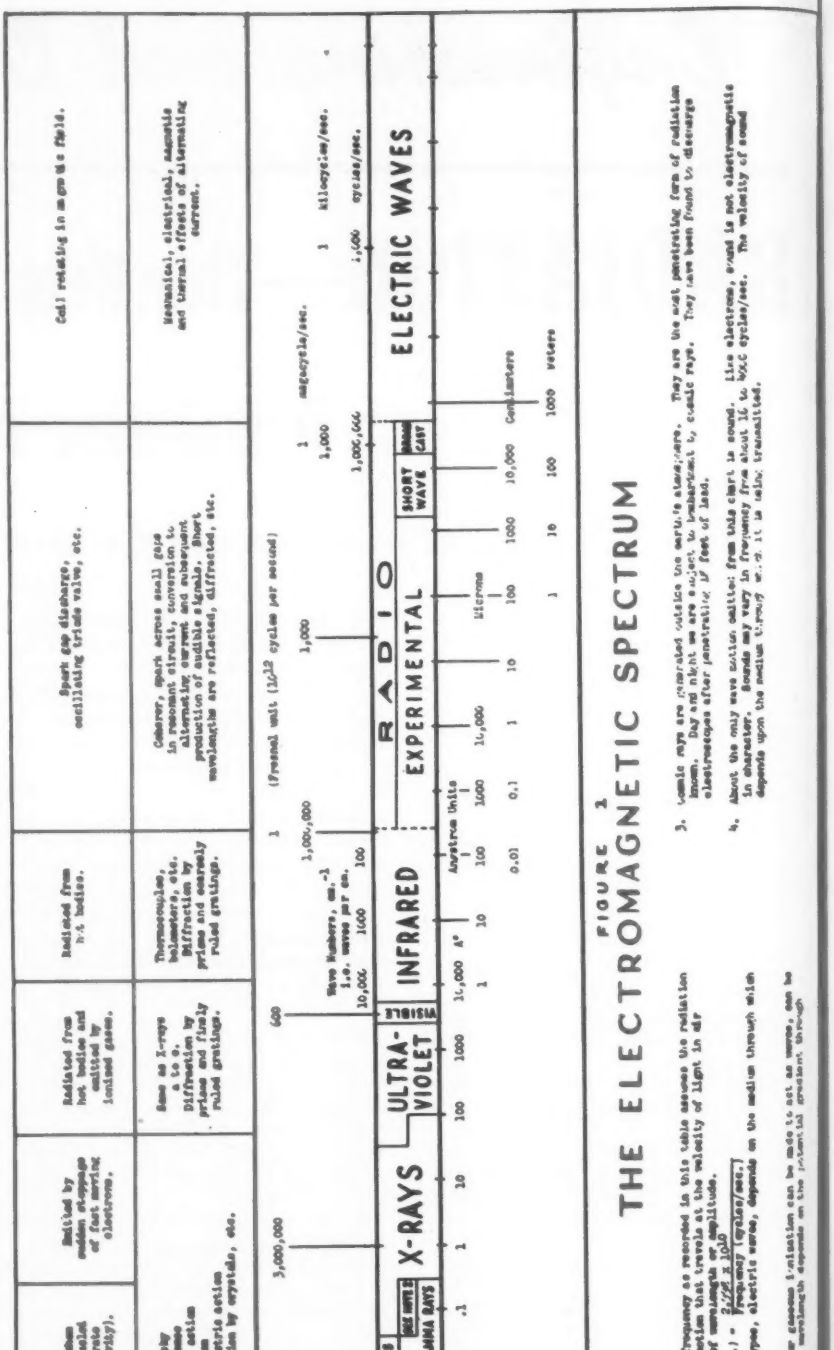
*Socony-Vacuum Oil Co., Inc., research and development division.

of magnitude as the distance between wave crests in an X-ray beam. Thus the atomic building blocks can act as diffraction centers and the crystalline material as a diffraction grating for an X-ray beam.

Specific examples of the use of X-ray diffraction in a petroleum laboratory include the identification of inorganic deposits found on valves, bearings, oil filters and other engine parts. Approximately 95 per cent of the inorganic materials encountered will yield an X-ray diffraction pattern by means of which it may be possible to identify them. In Fig. 2 are reproduced the patterns obtained in an analysis of various sediments which caused cloudiness in motor-oil addition agents. Even the addition agents themselves can be uniquely identified if they can be obtained as crystalline solids. The same method is useful in the study of catalyst structure. Other industries find the X-ray method extremely valuable in determining the structure of metals and alloys.

Certain limitations to X-ray diffraction methods should be pointed out. First, for compound identification the sample must be in a crystalline state, otherwise it will not yield a sharp line X-ray diffraction pattern. Secondly, except for a few simple cases the method is empirical. That is, patterns or data from known materials must be available for reference. Unknowns are identified by "matching" the unknown pattern with a known pattern in much the same manner as that of "fingerprinting." An example of direct visual matching is shown in Fig. 2. Third, the method is not usually sensitive to traces and, for complete identification, the unknown should not be too complex a mixture. The sensitivity and number of components which can be handled depends somewhat upon the composition of the sample. However, in general, the minimum concentration detectable is about 10 per cent and the sample should not contain more than four major components.

A tiny sample (only a few milligrams are required) is placed in an X-ray camera which may be similar to those shown in Fig. 3. A collimated beam of X-rays, usually homogeneous in wavelength, is directed on the sample. The sample acts as a diffracting medium wherein the orderly array of atoms or radicals which are the "building blocks" of crystalline materials diffracts the X-ray beam in much the same manner as a ruled grating surface diffracts light rays. These diffracted rays are recorded on photographic film or occasionally may be intense enough to be visible on a fluorescent screen. Exposures may require anywhere from a few minutes to many hours. A normal time for an all-purpose powder camera, 6 cms. radius, em-


METHODS OF GENERATION
Emitted when atomic nuclei disintegrate (radioactivity).
Emitted by sudden stoppage of fast moving electrons.
Radiated from hot bodies and emitted by ionized gases.
Radiated from h.f. bodies.
Spark gap discharge, oscillating triode valve, etc.
Coil rotating in magnetic field.
METHODS OF DETECTION
a. Photography
b. Luminescence
c. Chemical action
d. Ionization
e. Photoelectric action
f. Diffraction by crystals, etc.
Same as X-rays a to e. Diffraction by prism and finely ruled gratings.
Thermocouples, bolometers, etc. Diffraction by prism and coarsely ruled gratings.
Coherer, spark across small gap in resonant circuit, conversion to alternating current and subsequent production of audible signals. Short wavelengths are reflected, diffracted, etc.
Resonators, electrical, magnetic and thermal effects of alternating current.
FREQUENCY
i.e. waves per unit time
3,000,000
600
1
(Fresnel unit (10^12 cycles per second)
1,000,000
Wave Numbers, cm.^-1 i.e. waves per cm.
10,000
1000
100
1,000
1
megacycle/sec.
1,000
1,000,000
1
kilocycle/sec.
1,000
cycles/sec.
TYPE
INVISIBLE RAYS
COSMIC RAYS
SOFT X-RAYS
GAMMA RAYS
X-RAYS
ULTRA-VIOLET
VISIBLE
INFRARED
RADIO
EXPERIMENTAL
SHORT WAVE
BROADCAST
ELECTRIC WAVES
WAVELENGTH
i.e. length between wave crests
.01
.1
1
10
100
1000
10,000
Angstrom Units
1
10
100
1000
10,000
1
10
100
1000
10,000
Centimeters
0.01
0.1
1
10
100
Microns
1
10
100
1000
Meters
FIGURE 2
THE ELECTROMAGNETIC SPECTRUM
Remarks:
1. The relation between wavelength and frequency as recorded in this table assumes the radiation to be a sinusoidal transverse wave motion that travels at the velocity of light in air (2.998 x 10^10 cms./sec.) regardless of wavelength or amplitude.
Then Wavelength (cms.) = Velocity (cms./sec.) / Frequency (cycles/sec.)
The velocity of the low frequency types, electric waves, depends on the medium through which they are traveling.
2. Electrons emitted by a hot filament or caused ionization can be made to act as waves, can be diffracted by crystals, etc. This wavelength depends on the potential gradient through which they fall.
3. Cosmic rays are ionized rotating the earth's atmosphere. They are the most penetrating form of radiation known. Dayne Hitchcock was subject to bombardment by cosmic rays. They have been found to destroy electroscope after penetrating 15 feet of lead.
4. About the only wave motion omitted from this chart is sound. Like electrons, sound is not electromagnetic in character. Sounds may vary in frequency from about 16 to 4000 cycles/sec. The velocity of sound depends upon the medium through which it is being transmitted.

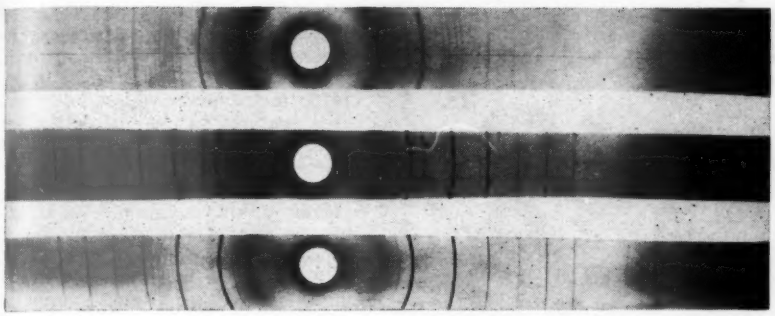


Fig. 2—X-ray diffraction patterns: The upper and lower patterns were obtained from samples of sediment which caused cloudiness in an experimental addition agent. The center pattern was obtained from a mixture of sodium chloride and a diatomaceous earth which was used as a filter aid. The upper sample was thus proved to be predominately the filter aid and the lower one sodium chloride

ploying copper X-radiation filtered through nickel foil so that only copper K-alpha rays enter the camera is about 6 hours. After development, the film may be compared visually (as shown in Fig. 2) with standard reference patterns, if such are available, or measured to calculate the interplanar spacing corresponding to each line. These interplanar spacings are independent of camera size and radiation employed and thus can be compared with data in the literature, perhaps taken under different conditions. Complete and versatile X-ray equipment is now available commercially. Such was not the case a few years ago. The unit designed and constructed in the Socony-Vacuum laboratories is shown in Fig. 4.

Electron Diffraction and Electron Micrography

The electron diffraction method as applied to industrial petroleum problems is very similar to the X-ray diffraction method. As the name implies, electron waves are diffracted rather than X-rays. Electron waves are slightly shorter in wavelength than X-rays but, unlike electromagnetic radiation of similar wavelength, electron waves do not have the intense penetrating power of X-rays or gamma rays.

Thus electron diffraction supplements X-ray diffraction when it is desired to study surface phenomena which may be too thin to be detected by means of X-ray diffraction.

In electron micrography, electron waves travel similarly to light rays in an ordinary microscope except that in place of glass or quartz lenses the electron microscope substitutes electrostatic or magnetic fields. Electron micrography has made it possible to see objects far smaller than can be resolved in ordinary microscopy. The maximum resolution possible at present probably does not exceed 0.01 microns (0.000,001 cms. or 100 Angstroms). A further advantage which is very important is the remarkable depth of focus found in electron micrographs, thus revealing more detail than could be seen heretofore under similar magnification.

Mass Spectroscopy

Mass spectroscopy yields direct information about the relative abundance of various weight molecular ion fragments which are formed upon ionization of a sample by a controlled electron stream. A sample of the hydrocarbon mixture to be analyzed is introduced into an evacuated chamber. The sample, still at very low pressure (ca. 10^{-4} mm. Hg), is subjected to bombardment by a well-regulated electron stream. The ions (charged particles) thus formed are drawn out of the ionization chamber and accelerated in an electrostatic field, whence they are caused to move through an electromagnetic field. The electric and magnetic fields are designed so as to sort out the ions according to their m/e or mass to charge ratio. This result can be read from a galvanometer. After scanning the molecular-weight range desired, the data, now in terms of relative abundance of various m/e groups, are converted to relative abundance of various molecules in the initial sample. Upon ionization, hydrocarbons yield many similar ion fragments and differ only in the relative amounts of such ions. Thus this latter step involves solving simultaneous equations which contain constants determined in the calibration of the instrument with known pure compounds. These constants indicate the relative proportions of each weight ion formed by the controlled ionization of each molecular component which may be present in the mixture.

Mass spectroscopy finds its greatest usefulness within the petroleum industry at present as a method of replacing the tedious low-temperature fractional-distillation analysis for the control of alkylation plants and in the evaluation of other low-boiling hydrocarbon samples. Rapid methods have been devised to analyze the "gas cut." The instrument time required per analysis is low (of the order of ¼ to ½ hour per sample). The calculating time may often be somewhat longer, however. Mass spectroscopy should be a very useful tool in the

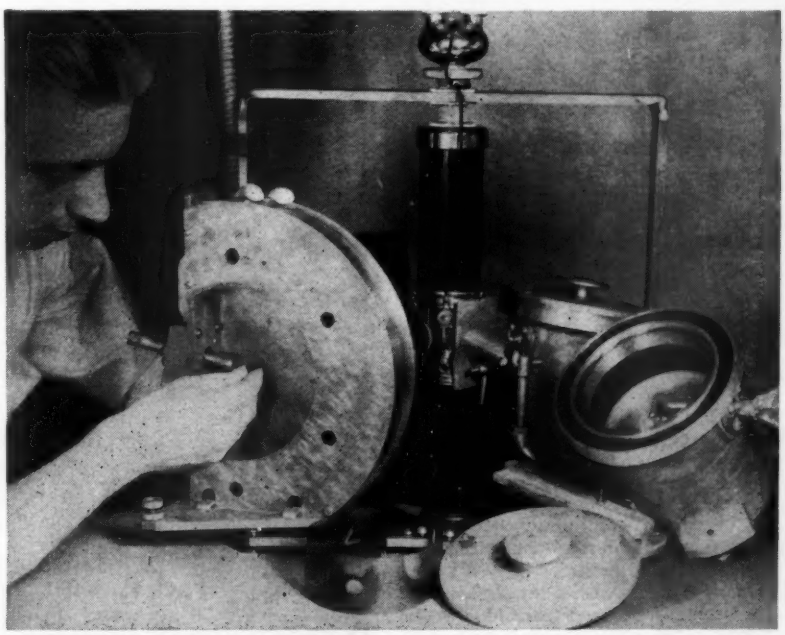


Fig. 3—X-ray diffraction cameras and X-ray tube: The illustration contains a large-diameter, cylindrical diffraction camera; several smaller cylindrical cameras which can be evacuated to control scattering of the weak, diffracted rays by air; a pinhole camera; and a Phillips-Metalix, hot-filament, permanently evacuated X-ray tube. The operator is placing a sample (tiny white tube showing above the operator's thumb) on a spindle in the center of a camera

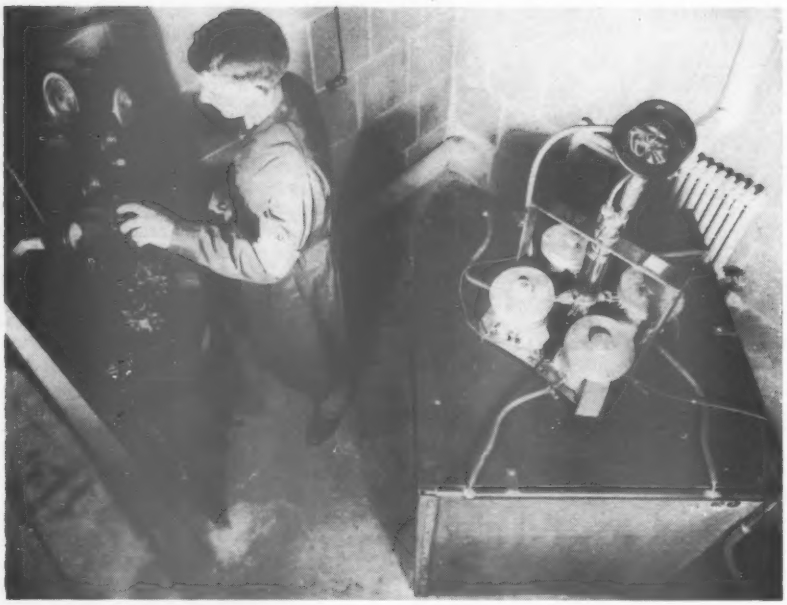


Fig. 4—Complete X-ray diffraction equipment: Four of the evacuable powder cameras are shown in position around the X-ray tube. The high voltage equipment is under the table and protected by the metal screening. The operator is adjusting the intensity of the X-ray beam. All the controls and meters are conveniently grouped on one panel board

analysis of surface gases in this method of petroleum prospecting. When the gas to be analyzed is a relatively simple mixture of low-molecular-weight components, the method is exceedingly sensitive and its accuracy probably exceeds other methods. Investigators report the detection of 0.001 per cent oxygen in nitrogen, 0.01 per cent methane in ethane, etc. In the study of isotopes (atoms of like atomic number but different atomic weights) mass spectroscopy is the most convenient method to use.

Emission Spectrography

Moving to longer wavelengths in the electromagnetic spectrum, the region from about 10 to 2,000 Angstroms is not of industrial importance at present largely because of experimental difficulties. In this region air, quartz and even the gelatin in photographic plates absorb the radiation. However, the spectrum from 2,000 Angstroms, through the visible region (roughly 4,000 to 8,000 A°), up to 12,000 Angstroms can be recorded on photographic plates. Many years ago, phenomena observed in this region formed the basis for the interpretation of atomic theory.

Everyone is familiar with the rainbow. This visible spectrum (the separation of white light into its component colors) which, in the case of the rainbow is produced by water vapor in the sky, is more readily produced in the laboratory by means of prisms or finely ruled gratings. The spectrum thus produced also contains light invisible to the eye. One commercial spectrograph in use in the Socony-Vacuum laboratories is shown in Fig. 5. This instrument uses a prism to separate the ultraviolet, visible and near infrared (2,000 to 10,000 A°) into component wavelengths. The prism used most frequently is of quartz and gives high dispersion (wavelength separation) in the ultraviolet. A glass prism may be substituted for the quartz to increase the dispersion in the visible and near infrared regions. Some investigators prefer instruments which use finely ruled gratings as the diffraction medium. The dispersion of grating instruments does not vary with wavelength.

If an unknown sample is burned and the light given off analyzed by a spectrograph, the elements present in the sample can be determined. Under proper conditions, atoms of any element will emit characteristic light. Such light is emitted when the outer electrons of an atom are disturbed; more correctly said, made to change energy levels. The metallic and metalloid elements can thus be readily excited by thermal energy supplied by a flame, arc or spark. The nonmetallic elements, on the other hand, are more difficult to excite. Spectra, or characteristic light, of the nonmetals is usually excited by ionization in a gaseous discharge.

Industrially then, emission spectrography is primarily useful for the exact and infallible identification of the metals and metalloids (phosphorus, arsenic, antimony and bismuth). It is especially useful in the determination of these elements where they may be present in very low concentrations. Most of the metallic elements can be positively and readily detected when present at only a few parts per million of the total sample. Elements which are difficult

(Continued on page 69)

Fig. 5—Spectrograph for use in and near the visible wavelength region (2,000 to 10,000 A°). The operator is adjusting the position of the photographic plate on which the spectrum is recorded. Pure graphite electrodes are in position in the arc stand. Four cupped electrodes in which various samples have been charred may be seen beneath the arc stand

Completion Practices at Oregon Basin Reduce Field's Well Requirements

by Neil Williams

Development of two producing horizons with single wells is being carried out systematically in the Oregon Basin field, Park County, Wyoming. At present only one zone is being produced, leaving the second to meet future oil requirements. This article describes drilling and completion practices in the field.

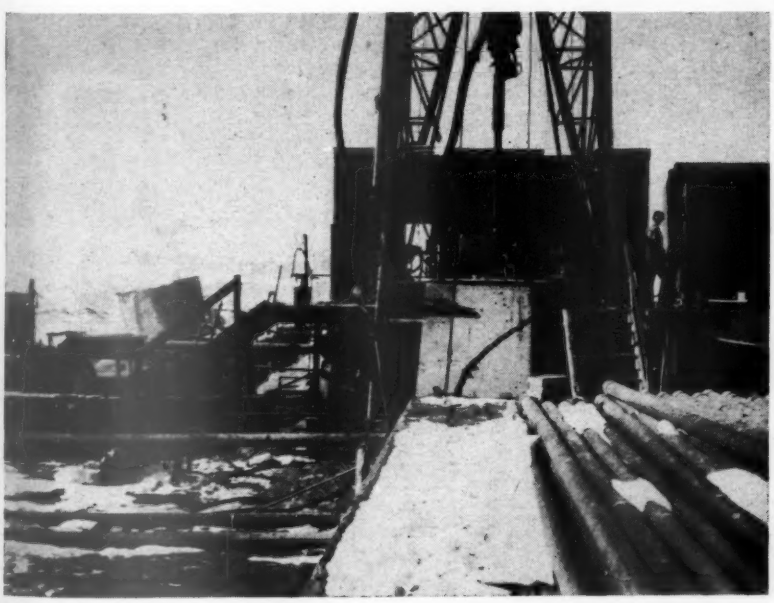
CURRENT development in the Oregon Basin field, Park County, Wyoming, is being directed to proving up the Embar lime and the Tensleep sand, the two principal "black" oil-producing horizons of the Big Horn basin district. Both of these formations, separated by an interval of from 150 to 200 ft., underlie fairly consistently the entire known producing area of the field. Their development calls for drilling all wells through the Embar lime, the upper formation, into the Tensleep, in which the oil string is set and cemented, and then completing the wells in one of the two formations, leaving the other to be produced when the first is exhausted.

The Oregon Basin field, until recently surpassed by the more flush Elk Basin field, producing from the Tensleep sand, has been the largest among the Big Horn basin fields, and one of the largest in the Rocky Mountain region. Active development has been under way since 1941 and the field now has approximately 110 wells and takes in an area about 10 miles long and about 3 miles wide.

Current production is approximately 16,000 bbl. with the individual wells producing from only one of the two horizons. With a second formation remaining to be produced in most wells, assurance is given of a sustained daily production if needed.

Inadequate market outlets and demand for this type oil, a heavy gravity, asphaltic-base crude, have discouraged any desire to produce both horizons at the same time and build up a larger current daily productive capacity. Consequently, dual completions have not been attempted, although, with all holes taking in both horizons, it is probable the wells could be converted readily from single to dual-zone production should a larger current recovery than that supplied from one zone be wanted.

Looking across Oregon Basin with typical drilling operation employing "jack-knife" derrick in foreground



Diesel-engined drilling rig in Oregon Basin field

So far, most of the wells have been completed in the Embar lime, the upper formation, leaving the Tensleep sand for later production. This would have permitted stopping the wells at that formation so far as present production needs are concerned. However, carrying the holes on down to the Tensleep requires only a small amount of additional drilling and casing, and as compared with having to drill separate wells later on represents substantial savings.

The particular advantage of the present program is that the potentialities of the Tensleep sand can be

determined fairly quickly with comparatively little additional expenditure over the cost of a well to the Embar lime. Then, when the latter reservoir is depleted, the wells can be recompleted easily and without delay in the lower formation, needing only a light, portable spudder or cable-tool unit to drill out cement.

Completion of these wells in the upper formation first is contrary to usual practice in multiple-zone drilling. Generally the wells are completed in the lowest formation first, and then as the lower formations are depleted, the wells are recompleted in successively higher formations. However, this is governed somewhat by the character of the formations and production, as most operators prefer to develop and deplete the better formations and most desirable crude first. In this case there is little choice so far as the oil and conditions are concerned. The crudes from the two formations are almost identical in their characteristics, and reservoir producing conditions are very similar, although it is considered probable the Tensleep will make more water. Here, operators started in the Embar and have largely just continued with that formation, and the comparatively few wells which now are being produced from the Tensleep are mainly those which have been recompleted following depletion of the Embar lime or which failed to find satisfactory saturation in the Embar.

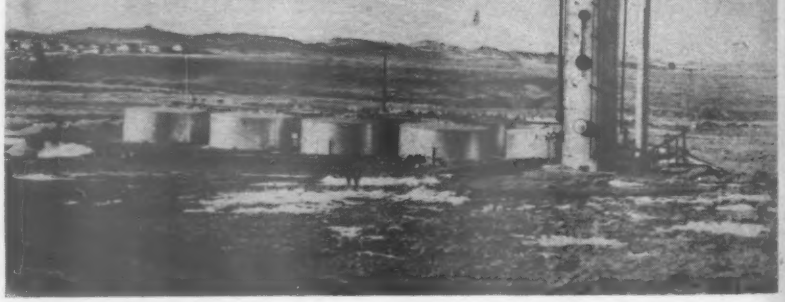
The Embar lime is topped from 3,190 ft. to 3,200 ft. and contains about 40 ft. of saturated section. The Tensleep sand is topped at 3,340 ft. to 3,400 ft. In starting wells, approximately 200 ft. of 10¾-in. surface casing is set and cemented to the top. Open hole, usually 8⅜ in. or 8¾ in. in size, then is carried through the Embar to a point about midway in the Tensleep, usually about 3,430 ft., where the oil string is set and cemented, using 350 to 400 sacks of cement. Oil strings range in size from 5½ to 7 in., depending mainly on what pipe is available.

Prior to running the oil string, an electrical log usually is made of the hole from the bottom to the surface-casing seat to determine accurately the points of contact and saturation. During drilling, the Embar generally is cored and drill-stem tested. For completion in the Embar, the casing is perforated with from 70 to 90 shots within the zone of saturation. Most of the wells then are acidized, using approximately 500 gal. This is placed in conventional manner and then washed and swabbed from the hole. Acidization has been practiced to a greater extent in the Oregon Basin field than anywhere else in the Rocky Mountain district. Through acidization, it has been found that the productive capacity of wells is materially enhanced. The favorable results obtained here are leading to more general application of the practice in other areas.

All wells are completed on the pump, although most of them require mainly agitation. The oil in the reservoirs is undersaturated and pressures are low. There is evidence of hydrostatic drive with water making its appearance in outer, down-structure wells, and advancing to and increasing steadily in successively higher wells. All pumping is by individual units, employing in most instances 30-hp. gas engines. General practice is to set pumps low, often at and frequently below the producing zone in the sump provided by the open casing run through the formation to the deeper Tensleep. Wells make from 100 to more than 200 bbl. per day in many cases.

Drilling conditions are typical of the Rocky Mountain district. Hard, steeply dipping formations, low bit footage and precautions to keep holes straight make drilling slow. Approximately 45 to 60 days are required for drilling and completions. From four to five rigs are being kept running in a systematic development program. Medium-depth capacity, contractor-owned mechanical rotary rigs powered by either gas or diesel engines have been used for most of the work, although at this time a power-line electric rig also is being run by Ohio Oil Co., one of the largest operators in the field.

Pumping installation in Oregon Basin field



One of newer central lease batteries in the field. Ohio Oil Co. camp in left background

Design of Mud-Conditioning Systems For Drilling Medium-Depth Wells

by Harry F. Simons

Most drilling rigs operating in North Central Texas in the past have been adapted to comparatively shallow drilling in which few mud-conditioning problems have been encountered. Generally, the equipment has been streamlined for quick moving, and with deeper drilling and increased problems the facilities for mixing mud and for mud circulation have been inadequate. Provision of increased pumping capacity and more adequate mud systems is now a major consideration.

ONE of the more pressing problems in the drilling of wells to medium depths in the North Central Texas area is that of mud conditioning and mud mixing. This is due to the formational conditions encountered on the one hand and to the lack of facilities on the average rig for meeting the problem on the other.

Formations drilled through in the medium-depth wells in the area include Pennsylvanian sands and shales, Mississippian limes, conglomerates and shales and limes, and Ordovician shales and sandstones. The term medium-depth wells is used as a description of depth which is not more than 7,500 ft. Within the area itself such drilling is generally referred to as deep drilling.

Only a few years ago most of the wells were stopped in the Pennsylvanian sands but more recently some good production has been found in the Mississippian and Ordovician formations. This has led to a drilling campaign in which wells of 6,000 to 7,000 ft. are quite common. The drilling of the deeper holes is quite different in comparison to drilling which is stopped in the Pennsylvanian sands.

The first of the deeper wells drilled in the area encountered considerable difficulty due to stuck drill pipe and loss of circulation or both. A number of holes were lost or were so expensive that deeper prospecting was deterred temporarily. In the past year most of the operators of drilling equipment have adopted mud programs which avoid the principal causes of stuck pipe, and eliminate or reduce the less serious cases of lost circulation. Where a very porous or cavernous formation is encountered the latter can be cured only by plugging off the zone or running casing.

The most common sources of trouble as far as stuck pipe is concerned are caving of the shales due to their becoming wet by water in the mud, and the formation of a too-thick filter cake on the well bore. The cure for both ills is the same, the use of a low-water loss, thin-filter-cake mud. In addition, one other mud characteristic which is watched is the viscosity. This is kept fairly high so that the cuttings and cavings, if any, will be washed out of the hole by the fairly low-velocity mud stream.

Practically all of the drilling in the area is done with mechanical rigs powered by two or three internal-combustion engines and having only one pump. These rigs are designed for quick moving and to a certain extent a compromise has been struck in the interest of over-all efficiency. Mainly the rigs lack sufficiently large pumps for drilling to such depths and in some instances they also lack horsepower necessary to produce a fluid stream of adequate volume. For this reason viscosity must be substituted for velocity in order to keep the hole clean.

From an operational standpoint there is another serious drawback and this is the actual introduction of the necessary admixtures into the

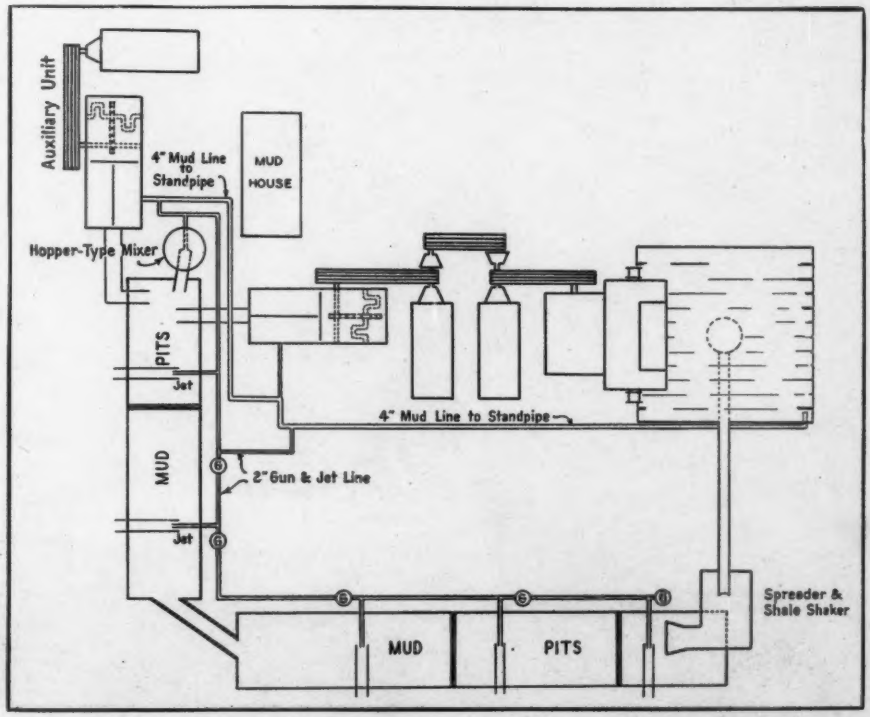


Diagram of mud pits and drilling equipment on rotary rigs showing location of auxiliary mud pump and method of tying in to line to standpipe and to mud and jet lines

mud. As only one pump is available (generally with a 12, 14 or 15-in. stroke and liner sizes varying with the engine horsepower on the rig) the rig must either be shut down while mud is mixed or it must operate with an insufficient and often dangerously low-velocity mud stream.

Much has been written about the advisability of having a standby pump available on drilling rigs of all depths. From an economical angle it involves whether the time the rig is shut down, or its efficiency reduced, is great enough to justify the extra investment and operating cost of another pump and possibly an additional prime mover. There is also the factor of risk to be considered and the elimination of the danger of getting stuck and ending up with a costly fishing job.

The addition of another pump to be driven through the compounding mechanism often entails considerable redesign of the drilling rig. There are also other drawbacks such as the complication of problems of rigging up and failure of one of the engines or the compounding mechanism of the rig so that both pumps are shut down.

Several drilling contractors have solved the problem through the use of a separate standby unit which includes a pump and an engine. This can be set at any point which is convenient so long as the suction can reach the mud pits. Generally it is set at the end of the mud pit as shown in the accompanying diagram. The pump is quite often one size smaller than that used for the regular mud pump although it may be, and often is, the same size. Principal reason for using a 12-in. pump instead of 14 or 15-in. pump is that a smaller engine can be used, the entire unit is much easier to handle and the investment is not so great.

If a contractor has several rigs operating in the area he may transfer the standby pump from rig to rig as it is needed. The main trouble with this method is that quite often two or more rigs have reached critical depths simultaneously and have need for the standby pumping unit at the same time.

Design of Mud Systems

Normally the standby pump is hooked into the mud line to the standpipe so that it may be used to maintain circulation while the regular pump is being repaired or some trouble on the rig is being cured. The mud-mixing line from the standby pump is connected to the hopper-type mixer and in most cases the regular pump is hooked up in a similar fashion. This gives the maximum flexibility.

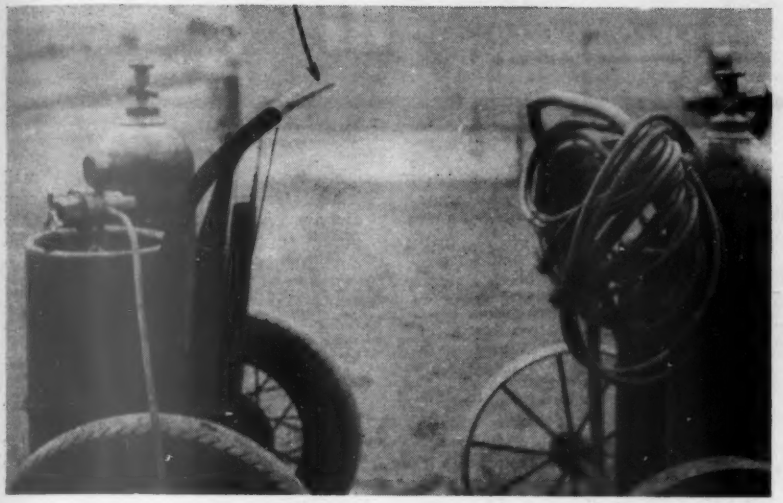
Another method which supplies a means of mixing the mud although it does not provide a standby pump is the use of some method other than the hopper, or jet-type mixer for adding to the circulating system.

An entirely different method of mud mixing which is being currently tried out on a rig operating in a medium-depth pool in Montague County is shown in the accompanying photograph. It is actually a combination jet type and a paddle mixer with its own power source which is a 5-hp. engine. It consists of a horizontal barrel of 16-in. casing with paddles attached to a shaft through the center, a centrifugal pump, the engine for driving both the paddle shaft and the pump and a jet-type mixer. The outlet from the barrel can be controlled so that fluid can be retained until thoroughly mixed by the paddles. Operation can be continuous with admixtures being added through the jet-type mixer while at the same time the fluid is stirred and some of it allowed to flow into the mud stream.

One of the principles of mud control frequently overlooked is that admixtures which contain bentonite cannot be used to their maximum efficiency unless thoroughly mixed. In most mud-mixing systems the contact of the bentonite with the water in the mud is not intimate enough to utilize the bentonite fully until it has passed through the pump at least one time. This often leads to the use of excessive amounts of the material with the result that other treatment of the mud is required or at least it amounts to wastage of the bentonite. The paddle-type mixer provides an intimate mixing which produces an improved mud with less admixture being used, and in addition it can be operated independently of the mud pump.

Mud mixer installed on rig in North Central Texas field has barrel with paddles and centrifugal pump for supplying fluid to jet-type mixer driven by small internal-combustion engine all mounted on a single skid

PLANT PRACTICES

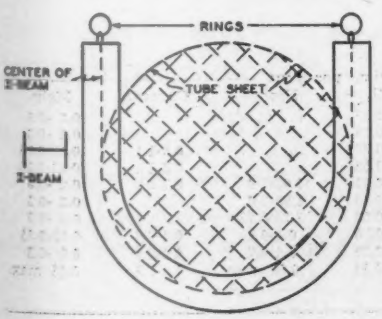


Attachment for Plant Welding Cart

IN any refinery it is often necessary to transport a welding cart with its oxygen and acetylene or propane tanks from one spot to another where a job is to be done. The pull chain slides back and forth, throwing the cart off balance, and frequently bending it out of shape. To obviate this situation, oil-company mechanics devised the "loop" or fitting shown in the photograph on one welding assembly, one being shown which is not so fitted. It is a simple segment of a ½-in. steel sheet cut to the shape of a trapezoid about 6 in. on its longer base. A hole of any desired size, 1 in. or thereabouts, is cut through the bracket, through which a cable or chain may be passed to attach it temporarily to a truck or tractor. Or, a clevis may be fitted to the rear of truck or tractor, with spread greater than ½ in., wide enough to accept this bracket, with holes cut through the clevis so a bolt may be passed through them and the hole in the bracket to attach it to the conveyance.

Loop for Handling Tube Sheets

A SIMPLE and convenient tool to facilitate the handling of heat-exchanger tube bundles has been devised at a Midwest refinery. A simple channel iron is bent carefully into a half-circle of the same or slightly greater radius as that of the tube sheets on the bundle, and the ends of the beam are extended parallel to a point approximately level with the upper edge of the sheet when in its "cradle." A ring of convenient diameter is welded to each end of this cradle into which a chain or rod may be looped, by means of which the crane may hook on, lift, and transfer the tube bundle as desired. As many different loops or cradles must be made as there are different sizes of sheets or bundles to be handled. By this means sheets may be handled safely without fear of marring tubes, or of distorting the bundle.



Forming Press

FACED always with the necessity for making all sorts of odd shapes of metal equipment, oil-company mechanics devised a unique and sturdy one by welding an air cylinder, taken from the brake system of a dismantled tank car, in a horizontal position to a frame made of two 8-in. I-beams, to which are welded legs of the same beams to raise the working level of the press to the desired height. To the outer end of the plunger a clamp is fitted, into which the shank of the press head is clamped. This press head of 1-in. by 2-in. steel is bent downward and again bent into a horizontal position, and reinforced by welding a top rib along its entire length. Welded to the end of this plunger, at right angles, is a similarly reinforced crossbar approximately 10 inches long, which is moved back and forth by the cylinder's piston, nearly touching the raised bed of the steel table. A flexible rubber hose connected the air cylinder to a source of compressed air at 100-lb. gage.

In operating the press, forms are made of the exact size and shape of the article to be made; the material — rod, pipe, sheet, etc. — from which it is to be constructed is placed between the plunger head and the form which is backed by a heavy stop, and the air pressure turned on, forcing the material to conform to the shape of the form or mold. For example, pipe bends are made by bending pipe of the desired size over a form of the required dimensions. Right-angled bends are made in pipe, rod, or sheet by forcing the material into a sharp right angled cut in a heavy 2-in. slab of steel. Alloy tapered collars are formed from tubing such as may be used to cover plain carbon steel plugs in cracking coil return bends. Dozens of these forms have been made up and their use has reduced the time required to make many of these items, used in large numbers around the refinery, to a small fraction of that required to make them by older hand methods formerly used.

McKnight Clamp Is Emergency Leak Stopper

FACED with the necessity for keeping critical products "coming," and thus keeping important units on stream whether or no, M. A. McKnight, maintenance chief for a large division for Gulf Oil Corp., Port Arthur, Tex., devised the trick known locally as the "McKnight clamp" to cover and stop leaks in lines, valves and other equipment, leaks which otherwise would necessitate shutting down the unit for replacement of the leaking part.

The principle of the clamp is simple. Assume that a large—or small—gate or other valve is leaking, split so that it cannot be repaired in place; it is on a hot line in a cracking unit, the product from which is so vital that the unit is shut down only when absolutely unavoidable. Around the valve a box is built of wood or any suitable sturdy material, so as to completely enclose the valve. In some cases, as in the instance of a leaking packing gland which cannot be packed so as to stop the leak, this box may enclose the entire bonnet and wheel or stem of the valve. Into this box, open at the top, is poured a cement which may be composed of cement and sand, of litharge and glycerin, a mixture of the two, or of the litharge-and-glycerin "superimposed" on the cement and sand. Before pouring the cement a drawoff line consisting of a length of small pipe long enough to extend beyond the box and fitted with a gate or other valve, is installed. Through this drawoff the leaking liquid or vapors are carried away from the leak while the cement is setting. After the cement has set this drawoff is closed, either by removing the bleeder valve and screwing a cap or plug onto the small line, or by simply closing the valve itself. This system closes off the leak effectively and still permits the operation of the unit until such time as other causes may force its shutdown, when the faulty member may be removed and replaced with a new one.

For low-temperature lines the above constitutes the entire job of "clamping" the leaking part, and serves admirably for the purpose. If the leak is in a hot line, or even a vapor or liquid line on a primary or other distillation unit, the cement alone is inadequate; it cracks under the temperature, even after setting. The variant here is to allow the cement to set for 24 hours and crack; meanwhile drawing off the leakage as indicated. When the cement is set, a short line is attached to the drawoff line and to a rebuilt heavy grease gun such as is used to inject heavy lubricating greases into difficult reachable working bearings. On the handle of this gun which is threaded and fitted with wheel originally, a bent lever crank is welded; also when extremely high pressure is required, a pipe wrench may be used to turn the screw-driven plunger rod. This device will put 5,000 lb. per sq. in. pressure on the litharge-glycerin placed in the cylinder. By this gadget the litharge-glycerin mixture is forced into every interstice and crack in the cement and when allowed to set, which occurs within a few minutes, the entire clamp is leakproof, even under high temperature.

A third form of the clamp is applied under more than ordinary elevated pressure, and in different spots such as leaking flange joints, etc. When a flange gasket, for example, starts leaking, a strip of steel sheet, somewhat wider than the two flange edges, is clamped peripherally around the leaking joint with a gasket such as asbestos sheet between flange metal and strip, the strip drawn extremely tightly. A small valve-fitted entrance line is screwed or otherwise attached to the strip with the inner open and entering the inside of the covered flange. With the reinforced pressure gun litherage-glycerin is forced into the joint to fill every crack and crevice and the pressure maintained until the cement sets—in a few minutes.

Clamps such as these described and illustrated in the accompanying photographs have held perfectly for months, even years in the case of water mains, until enforced shutdowns for other causes permit easy and low-cost replacements.

Right: Condenser boxes when exposed to corrosive conditions are coated in cement or gunite covering. Below, left: Seriously corroded valve is surrounded with a cement cloak and kept in service indefinitely, when shutdown is too expensive. Below, right: Seriously corroded valve on a busy water line is kept in use under emergency conditions by a "clamp" of cement

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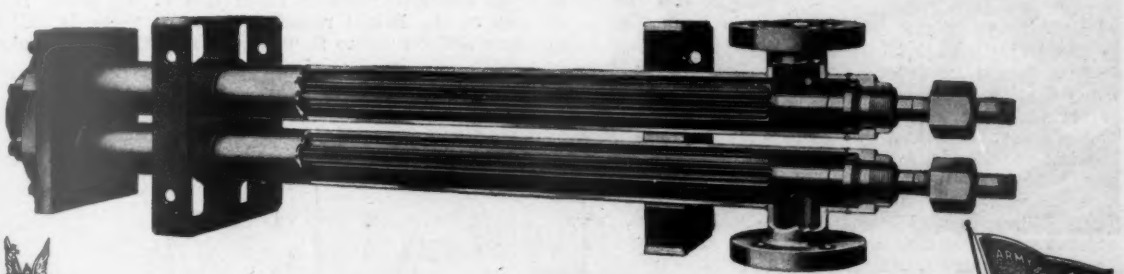

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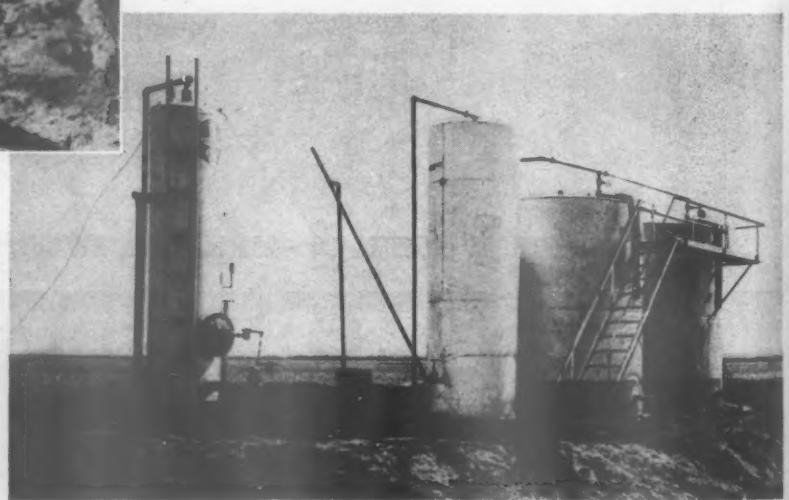
OPERATING IDEAS

Substructure and Working Platform

DUE to a lack of structural steel the engine substructure shown was constructed from old 6⅝-in. drill pipe. To increase the bearing surface of the bottom runners, two lengths of the pipe were used in each. The double runner also provides for a stronger weld on the uprights. For field moves the working platform remains in place. The support for the floor is provided by lengths of 4½-in. drill pipe laid across the top of and bolted to the substructure. The planks are nailed to a 2-in. by 4-in. timber bolted on the inside to a channel iron on top of the 4½-in. drill-pipe supports, or wings. Braces from bottom of the substructure to the ends of the 4½-in. drill pipe add rigidity. For highway moves the framing sill and the working platform are removed.

Small-Diameter Gun Barrel

OPERATION of leases producing small quantities of oil require that the amount of steel used, and hence the investment, be kept at a minimum. As far as surface equipment is concerned the use of as small a tank battery as possible, small separator and small gun barrel is effective providing the desired flexibility is maintained. In one field, where the wells are not heavy producers, most of the operators use a gun barrel, or hay tank, which is approximately only one-half the diameter of the stock tank. The volume of the oil handled is small enough to permit separation of the water from the oil and as the height remains the same there is still ample pressure differential to flow the oil into the stock tanks.



Emergency Tool-Joint Rebuilding Job

TOOL-JOINT practice has been affected by the general trend and by the scarcity of tool joints. The accompanying picture shows an emergency rebuilding job in which the bands of reinforcing and hard-facing metal have been applied to the thread end as well as the pipe end of the tool joints. This procedure is not normally followed as the box is apt to warp.

Methods for Engineering Peak Power Requirements for Single Pumping Rigs

by E. A. Braker*

THE power requirement of the conventional mechanical oil-well pump varies considerably throughout a cycle of one upward and one downward stroke of the pump. This is due not alone to the fact that useful work is performed only during the upward stroke, but also to the large variation in pump-plunger speed throughout each stroke.

To make use of the most economical size prime mover and to promote smooth operation, it is necessary to develop ways of bringing the peak and the average power requirements in the pumping cycle as near together as practicable. Progress to date in this respect has been limited mainly to counter balancing the weight of the polished rod and one-half the effective weight of the oil above the pump plunger. This theoretically divides the power requirement equally between the upward and the downward stroke.

Fig. 1 identifies the various elements that make up the surface equipment of a typical mechanical single oil-well pumping installation. It will be noted that the power unit, or prime mover, drives the speed reducer through V-belts. Part of the counterbalance is shown mounted on the walking beam and part on the pump crank.

*International Harvester Co.

One of the most pressing problems in the design and operation of individual pumping units is to provide means for smoothing out the peaks in power requirements during the pumping cycle. If maximum and average power requirements during the cycle can be brought closer together, prime movers of smaller and more economical sizes can be employed. This article, presented in two parts, offers possible solutions for eliminating the problem. The second part of this article will appear in the January 20 issue of the Journal.

For example, wells 5,000 ft. deep may have polished-rod strings weighing approximately 9,000 to 10,000 lb. and a fluid weight up to 7,500 lb. depending on the pump-plunger diameter. Number of pump working strokes per minute may vary from a low of about 6 to a high of around 35. The standard average is 20 s.p.m. Length of the stroke may vary for different pumping rigs from about 18 in. to as long as 132 in.

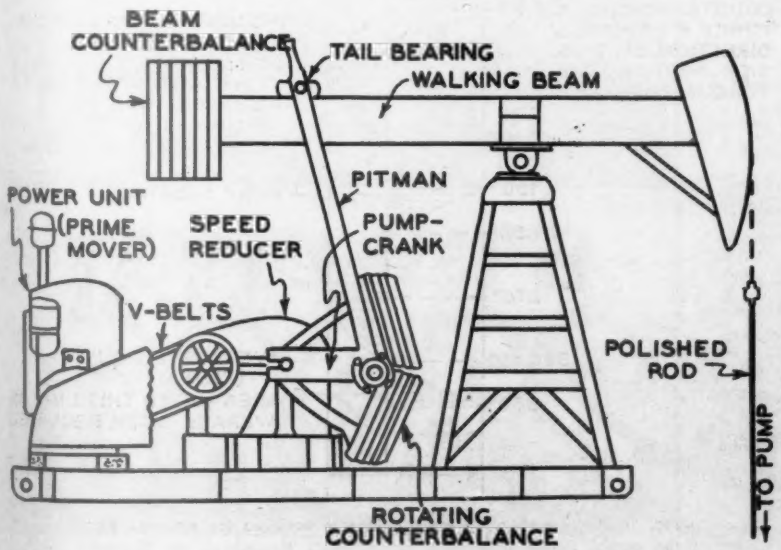


Fig. 1: Conventional mechanical single oil-well pumping rig

Speed-Reducer Torque With Conventional Counterbalance

Peak torque at the pump crank must be known in order to select a speed reducer of the proper A.P.I. rating. While not entirely true, it is customary to simplify torque calculations

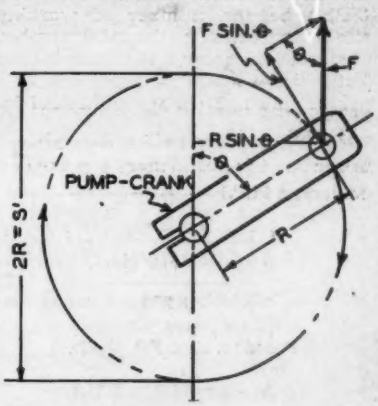


Fig. 2

F = Net polished-rod loads, pounds
R = Pump-crank radius in feet = Stroke S/2 in feet
θ = Pump-crank angle in degrees
Torque, lb.-ft. = FR sine θ

by assuming a uniform load at the pump-crank pin and simple harmonic motion. The calculations are made conservative by considering the maximum acceleration load that theoretically occurs at or near the ends of the stroke as being effective in the middle of the stroke where the torque arm is greatest.

In Fig. 2, F is the net polished-rod load in pounds at the speed-reducer pump-crank pin, R is the crank radius in feet and θ is the crank angles in degrees.

Torque in mechanics is defined as force times lever arm, where one is at right angles to the other. In Fig. 2, the lever arm is the pump-crank

radius, R, and the force at right angles to it is F sine Θ. Therefore:

$$\text{Pump-crank torque, lb.-ft.} = FR \sin \Theta \quad (1)$$

Since sine Θ increases from 0 to 1 for angles of 0° to 90°, and decreases from 1 to 0 for angles of 90° to 180°, it is evident that the pump-crank torque varies from 0 at the ends of the stroke to a peak of FR at the middle of the stroke. If the pump crank rotates at a uniform speed, the theoretical horsepower required at the prime-mover flywheel will correspondingly vary.

Relationship Between Peak Torque and Average Horsepower

That there is a close relationship between pump-crank torque and horsepower can be easily demonstrated. Torque has already been defined. Horsepower is equal to force in pounds times distance moved in feet per minute divided by 33,000.

Total distance that the force F in Fig. 2 travels per minute is equal to the number of up and downstrokes made per minute multiplied by 2R, the stroke length S in feet. Letting (SPM) be the number of working strokes per minute, the total number of strokes per minute is then 2 (SPM). Total distance that the force F travels per minute is 2 (SPM) multiplied by 2R. Therefore:

$$\text{Average H.P.} = \frac{F(2R) \times 2(SPM)}{33{,}000} = \frac{FR\,(SPM)}{8{,}250} \quad (2)$$

$$\text{Peak torque, FR, lb.-ft.} = \frac{\text{Average H.P.} \times 8{,}250}{(SPM)} \quad (3)$$

Because of frictional losses in the drive, the actual average horsepower required from the prime mover is usually estimated as 20 to 25 per cent greater than that required at the pump crank.

Peak and Average Torque With Conventional Counterbalancing

To derive a formula for the theoretical flywheel effect needed to maintain the speed variation of a prime mover within desired limits with a fixed throttle setting, it will be necessary first to develop the relationship between peak and average torque at the pump crankshaft.

Work energy in foot-pounds equals force in pounds times distance moved in feet. Referring to Fig. 2, replace F sine Θ by f, the average tangential force in pounds acting at the crankpin while moving in a half-circle the distance πR. The average torque is then fR. Work done by the forces f and F in moving the pump crank from the top to the bottom of the stroke must be the same. Therefore:

$$\text{Work per stroke, ft.-lb.} = \pi fR = 2FR$$
$$\text{Av. torque, lb.-ft.} = fR = 2FR/\pi = FR/1.57 \quad (4)$$

This shows clearly that without flywheel effect in the power transmitting system, the maximum power requirement from the prime mover is 57 per cent greater than the average horsepower needed.

Average Work per Degree of Pump-Crank Motion

It has been shown that the total amount of work done per stroke involving 180° of pump-crank motion is 2 FR. If this work were evenly divided throughout the stroke, the amount done during each degree of crank motion would obviously be 2FR/180. Therefore if the crank moved through an angle of $\Theta_2 - \Theta_1$ the amount of work done at the average rate would be

$$\text{Average work, ft.-lb.} = 2FR\left(\frac{\Theta_2 - \Theta_1}{180}\right) = \left(\frac{\Theta_2 - \Theta_1}{90}\right) FR \quad (5)$$

Load Variations With Conventional Counterbalance

Fig. 3 shows graphically both the average and the instantaneous torque and work requirements throughout a complete revolution of 360° of the pump crank under the assumed theoretical operating conditions. The instantaneous torque requirement is equal to the average momentarily only four times during the cycle. The remainder of the time it is either more or less than the average.

We now begin to see the advantage of having work-storage reservoirs such as high-speed flywheels or properly synchronized weights in the power-transmitting system. If fly-

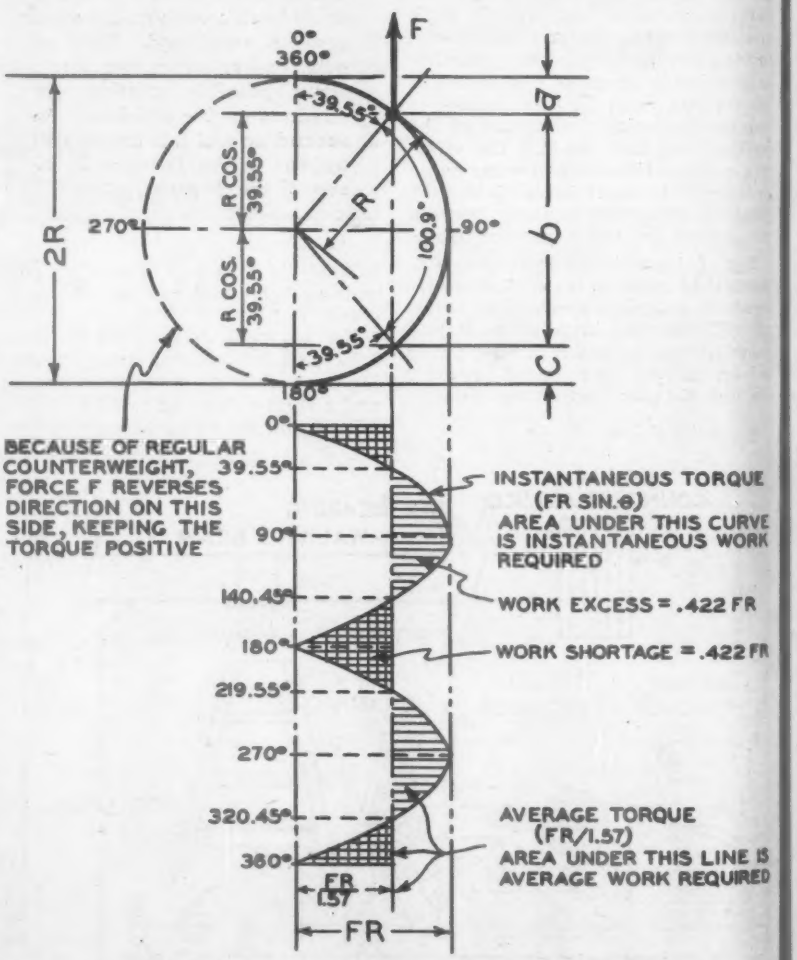
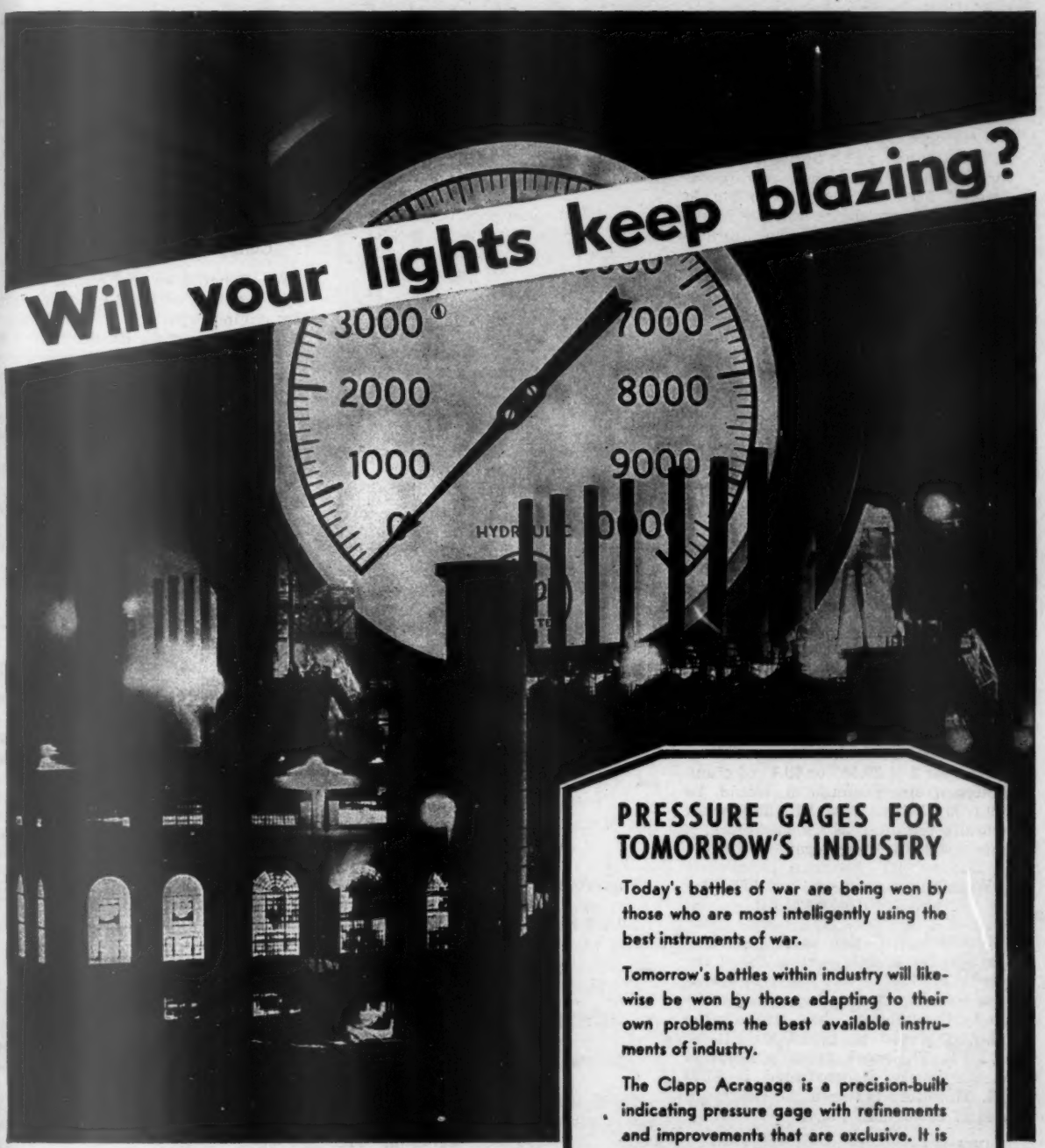


Fig. 3: Diagram showing the relationship between the average and the actual torque and work requirements throughout the theoretical oil-well pumping cycle with conventional counterbalancing



pressure GAGES

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wheel effect alone is used, the amount required will depend on the allowable speed variation throughout the pumping cycle and the foot-pounds of work to be stored and delivered periodically in the cycle.

A formula for the theoretical energy in foot-pounds to be periodically absorbed and released can readily be derived. First, as indicated in Fig. 3, the pump-crank angles must be found at which the instantaneous torque equals the average. This can be done by equating Formula 1 for the instantaneous torque to Formula 4 for the average torque and solving for the angle Θ as follows:

$$FR \sin \Theta = FR/1.57$$
$$\text{Sine } \Theta = 1/1.57 = 0.6366$$
$$\Theta = 39.55°$$

Referring once more to Fig. 3, note that the vertical distance in feet that the pump crank moves at less than average torque is a + c. But a = c = R — R cos 39.55°. Therefore:

$$a + c = 2(R - R \cos 39.55°) = 0.458\ R$$

Again recalling that work is force time distance moved, the work input per stroke at less than average torque is (a + c) F, or 0.458 FR. Total work input is 2 FR. Therefore, the work input at greater than average torque is 2 FR — 0.458 FR or 1.542 FR.

If the work were evenly distributed throughout the stroke, the amount required for 2 × 39.55° or 79.1° of crank motion from Formula 5 would be (79.1/90) FR or 0.88 FR. The work actually required, as shown before, is only 0.458 FR. Therefore:

$$\text{Work shortage, ft.-lb.} = 0.458\ FR - 0.88\ FR = 0.422\ FR \quad (6)$$

Similarly, if the work required through the middle portion (b) of the stroke or 180° — 79.1° of crank motion (see Fig. 3) were evenly distributed throughout the stroke, the amount would be (100.9/90) FR, or 1.12 FR. The work actually required as previously demonstrated is 1.542 FR. Therefore between the crank angles of 39.55° and 140.45°

$$\text{Work excess, ft.-lb.} = 1.542\ FR - 1.12\ FR = 0.422\ FR \quad (7)$$

Formulas 6 and 7 show, as they should, that the shortage and excess of work done below and above the average during the stroke exactly balance. This variation in work or power requirements is repeated in the upward stroke. It must be taken care of by flywheel effect, or other means, if smooth operation of the pumping unit is to be obtained.

Wr^2 With Conventional Counterbalancing

First let us consider that the entire variation in load energy requirements is to be taken care of by the flywheel on the prime mover. The amount of energy lost by a flywheel of weight W in pounds and radius of gyration r in feet in going from an r.p.m. of N_1 to a lower r.p.m., N_2, is given by the following formula, the derivation of which can be found in any good handbook:

$$\text{Flywheel energy ft.-lb.} = \frac{Wr^2}{2g}\left(\frac{2\pi N_1^2}{60}\right) - \frac{Wr^2}{2g}\left(\frac{2\pi N_2^2}{60}\right)$$

Since g is the standard gravitational acceleration constant equal to 32.2 ft. per second per second, the preceeding formula reduces to:

$$\text{Flywheel energy, ft.-lb.} = \frac{Wr^2\,(N_1^2 - N_2^2)}{5{,}870} \quad (8)$$

Formulas 6 and 7 show that the theoretical load variation to be handled by the oil-well-pumping-engine flywheel is 0.422 FR. Letting N be the average engine r.p.m., N_1 the maximum r.p.m. and N_2 the minimum r.p.m., the Wr^2 in pounds — feet squared necessary in the engine flywheel for a desired coefficient of speed fluctuation, $N_1 - N_2/N$, may be calculated as follows:

$$0.422\ FR = Wr^2 \frac{(N_1^2 - N_2^2)}{5{,}870}$$

But $N_1^2 - N_2^2 = (N_1 + N_2)(N_1 - N_2)$, and $N_1 + N_2 = 2N$.

Therefore:

$$0.422\ FR = Wr^2 \frac{(N_1 - N_2)}{5{,}870} 2N$$

$$N_1 - N_2 = 1{,}240\ FR/Wr^2N \quad (9)$$

$$C = N_1 - N_2/N = 1{,}240\ FR/Wr^2N^2 \quad (10)$$

$$Wr^2 = 1{,}240\ FR/CN^2 \quad (11)$$

These three formulas are of course not applicable to the flywheels of prime movers for pumping rigs equipped with the double-speed torque-reducing counterbalance described later in this article. Such pumping rigs, as will presently be demonstrated, need only a fraction of this flywheel effect for equivalent smooth operation.

Even in the case of single-well pumping units balanced in accordance with current, standard practice, Formula 11 should give a larger Wr^2 for the prime-mover flywheel, clutch and pulley than actually required to maintain engine-speed variation within desired limits. This is because the sizable flywheel effect of the driven pulley, speed-reducer gears and rotating counterweights has been entirely neglected. In practice, therefore, it is probable that the theoretical constant of 1,240 can be satisfactorily replaced by a round figure such as 1,000. The A.P.I. may also want to standardize on a coefficient of speed fluctuation, C, of approximately 0.05. Formula 11 would then simplify to $Wr^2 = 20{,}000\ FR/N^2$.

Example for Calculating Wr^2 With Conventional Counterbalance

What should be the Wr^2 of the flywheel, clutch and pulley of a pumping engine with an A.P.I. rating of 20 hp. for continuous duty at 1,200 r.p.m.? The engine will operate at rated speed and power on a single-well pumping rig counterbalanced in accordance with standard practice, and making 20 working strokes per minute. Engine-speed fluctuation is not to exceed 5 per cent.

Solution:

Average hp. = 20 (SPM) = 20
N = 1,200 C = 0.05.

FR, from Formula 3 = 20 × 8,250/20 = 8,250 ft.-lb.

Wr^2, from Formula 11 = 1,240 × 8,250/0.05 × $1{,}200^2$ = 142 lb.-ft.^{2}

Because of friction and flywheel effect already in the drive, it is probable that an engine flywheel Wr^2 of 100 to 115 lb.-ft.^{2} would give the desired results. However, on the basis that whenever possible the cause rather than the final effect should be treated, it is recommended that consideration be given to use of the peak-torque-reducing counterbalance described below instead of the extra-heavy special engine flywheel, which would then be unnecessary.

BOOKS

VLADIMIR N. IPATIEFF. — Testimonial in Honor of Three Milestones in His Career.

This 74-page volume was published on the occasion of Dr. Ipatieff's seventy-fifth birthday, which coincided with his golden wedding anniversary and the completion of 50 years as an "outstandingly useful member of the chemical profession," to "preserve the memories of the threefold celebration."

The employes of Universal Oil Products Co. honored the occasion with a banquet at which Dr. and Mrs. Ipatieff were the guests of honor. The volume contains the addresses of the several speakers at the testimonial dinner, the congratulatory messages, a list of the honors bestowed on Professor Ipatieff, and a list of his published works.

RADIATION—The New Analytical Tool

(Continued from page 44)

to identify uniquely by chemical means; for example, the alkali elements, are easily distinguished spectrographically. It has been stated that no metal has ever been made so pure that the spectrograph could not find impurities present.

The following brief description will illustrate the procedure followed in emission spectrographic analysis. The sample is burned to make it emit characteristic light. The most common and most sensitive method is to burn the sample in a direct-current arc. If the sample will conduct electricity and is of sufficient size, an arc can be struck between electrodes composed of the sample. Nonconducting materials and samples which cannot be used as electrodes directly are usually supported in cupped electrodes made from pure graphite. The arc consumes the sample and part of the graphite. Except for one portion of the emission spectrum, graphite (carbon) does not have many lines in its spectrum and thus does not seriously interfere in the interpretation of the resulting spectrum.

Organic materials, of prime interest in the petroleum laboratory, are ashed or charred directly in cupped graphite electrodes and these then burned in the arc. This process is somewhat laborious and a method at present in the development stage in the Socony-Vacuum laboratories, may overcome this difficulty. The proposed method would spray the organic liquid into the arc or spark and excite any metals present directly without the extra step of ashing or charring the sample.

The light from the burning sample is dispersed in a suitable spectrograph and recorded on a photographic plate. The recorded spectrum is then examined. The various elements appear at specific locations in the spectrum, thus their presence or absence in the sample may be determined. A typical plate on which some of the spectral lines are identified is shown in Fig. 6. An experienced operator in an elapsed time of not more than 3 hours after receipt of the samples could post results on the analysis of two catalysts, some spectra of which are shown in Fig. 6, as follows:

Fig. 7—Recording microphotometer: The optical density of lines on plates taken in the spectrograph shown in Fig. 5 is measured in this instrument when quantitative results are desired. The spectrographic method of quantitative analysis is empirical and procedures must be carefully worked out for each analysis

Synthetic Catalyst

Major metal = Si
Minor metal = Al
Trace metals (of the order of 0.1 per cent = Na
Very small traces (probably below 0.01 per cent = Mg, Ca, Fe
No other metals detected.

Natural Clay Catalyst

Major metals = Si, Al
Minor metals = Mg, Ca, Fe, Ti
Trace metals = Na, Mn, Sr
Very small traces = Pb, V, Ca, Cr, Ba, Li, Sn, Zr
No other metals detected.

The elements sought in a routine analysis include those reported above and B, Hg, Mo, Be, Cu, Cd, Ag, Zn, Ti, Co, Ni, W, K, and the metalloids P, As, Sb, and Bi which were not present in the two samples.

Quantitative analyses for the metals and metalloids can be made by spectrographic methods. The sample is burned, the spectrum recorded, and the photograph developed under rigorously controlled conditions. The optical density of chosen lines is measured on a microphotometer (see Fig. 7) and compared with those from known samples of approximately the same composition. A detailed description of quantitative spectrographic techniques cannot be included in so

Fig. 6—Photograph of ultraviolet emission spectra of various samples: Spectrum A—A synthetic catalyst. Spectrum B—A natural clay catalyst. Spectrum C—Nearly pure iron for wavelength reference. Spectrum D—Blank on graphite electrodes (over-exposed). The wavelengths in Angstrom units and elements responsible for some of the lines are noted

24 G-MV (ANGLE)'S DELIVERING Producing

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brief and general a review. To summarize, if samples are of a kind that must be burned in a direct-current arc, then the quantitative accuracy will probably not exceed ± 10 per cent of the amount of the element present. For example, if magnesium was present in a clay catalyst at 10 per cent, spectrographic methods would report it as 10 ± 1 per cent at best. However, if it was present at 0.01 per cent it might be reported as 0.010 ± 0.001 per cent. Quantitative spectrographic methods are especially useful to determine metallic elements in low concentration where the accuracy of the spectrographic method usually exceeds other analytical methods. If a large number of analyses of a given kind are to be made, then spectrographic methods are rapid and time saving.

Ultraviolet Absorption Spectroscopy

In addition to emission spectra, the readily accessible ultraviolet region of the spectrum from 2,000 A° up to the visible displays phenomena related to the structure of molecules. Molecules which contain resonating groups; for example, conjugated unsaturated carbon groups, exhibit selective absorption of ultraviolet light. Of particular interest to the petroleum industry, aromatic hydrocarbons and drying oils and resins yield characteristic ultraviolet absorption spectra by means of which such molecules may be identified. Saturated hydrocarbons do not absorb appreciably in this region. Thus the identity and concentration of some aromatic compounds (e.g. those which may be present in gasoline) can be determined without separation from the saturated hydrocarbons. An analysis has been reported wherein straight-run or saturated naphtha is split into five fractions over the range of 125-150° C. and these fractions analyzed for ethylbenzene and the three xylenes with an accuracy better than that of any other available procedure.

Absorptions in this wavelength region are caused by electronic transitions related to the resonating groups within the molecule. In aromatic compounds with aliphatic side chains these resonating groups are in the nucleus or ring portion of the molecule. Thus, altering the position of the side chain on the ring (e.g. o-, m- and p-xylenes) or adding side chains (e.g. toluene is benzene plus a methyl group) usually causes a marked difference in the UV absorption spectrum. But increasing the length of the side chain has less effect upon the spectrum.

For analysis, a weighed quantity of sample is diluted with a nonabsorbing solvent such as isooctane and placed in an absorption cell with quartz windows. Ultraviolet light, preferably from a continuous source such as a hydrogen lamp, is passed through the sample cell, dispersed by a quartz prism, and the resulting spectrum examined to determine regions of absorption. The spectrum may be photographed but small ultraviolet monochromators are available which detect and measure the spectrum by means of photocells. These are preferred for routine analysis for several reasons. First, photography and all its accompanying equipment and trouble is eliminated. The photocells measure the intensity of the UV light directly. Secondly, once a method is devised for a given analysis, it is usually not necessary to examine the whole spectrum but merely necessary to measure the transmission at a few specific wavelengths. The photoelectric instrument may be faster in such cases.

Raman Spectrography

Raman spectrography represents another application of the visible spectrum. Since it supplies somewhat the same information as the ultraviolet and infrared spectrographic methods already in use by Socony-Vacuum, this type of equipment has not been installed by our laboratories up to the present time. Raman methods yield information related to molecular structure. In Raman spectrography light of characteristic visible wavelength such as that from a mercury discharge tube is allowed to illuminate the sample. Light originating in the sample at a direction perpendicular to the incident beam is dispersed in a large aperture spectrograph and the resulting spectrum photographed and examined. This scattered and/or reemitted light coming from the sample contains light of frequencies corresponding to that of the incident beam plus or minus the frequencies of various vibrating groups within the sample and thus can be used to identify the parent molecules. It is exceedingly difficult in many cases to obtain Raman data as clear or well resolved as might be desired. Samples for Raman investigation must be well fractionated just as is the case in infrared. The photographic process complicates quantitative interpretation of the Raman records. Also, petroleum samples, especially those heavier than gasoline, usually exhibit fluorescence causing background fog in the Raman record and may completely obscure the Raman shifts. For such reasons, the method does not enjoy the popularity within the industry that is given infrared and ultraviolet methods. The Raman shifts are of very low intensity and exposures of the order of hours are sometimes required to record Raman spectra.

Infrared Spectrography

As we go to wavelengths longer than those of ultraviolet and visible light, the frequency of the radiation becomes correspondingly smaller. The extremely high-frequency vibrations of relatively short wavelength radiation, up to and including visible light, are due to electronic transitions with-

Fig. 8. Infrared Spectrograph: The infrared spectrograph is inside the metal housing under the crane. The electronic equipment which operates the bolometer detector is still in development stage. In the right side of the figure is the recorder on which spectrum appears

in atoms. Such radiation, when used for analytical purposes, thus most readily yields information concerning the kind of atoms, i.e., elements, which are present. Only in certain special cases can such radiation yield information concerning how the atoms are grouped together, i.e., concerning molecules. These special cases which are industrially important at present include the identification of certain aromatic and conjugated olefinic molecules by means of ultraviolet absorption measurements as described previously. Also any material which appears colored to the eye selectively absorbs visible light. Visible absorption when used in conjunction with other data can sometimes yield information concerning molecular structure. However, the major industrial interest in visible spectral absorption is as a unique and infallible method of specifying color.

Progressing to masses heavier than those of electrons, we find that the atoms themselves are constantly moving. As long as any molecule is not at absolute zero, the atoms within the molecule are constantly oscillating about their positions of equilibrium. The oscillation frequently is, to a first approximation, determined by the mass of the vibrating atoms and the valence forces which bind them together. For example, a carbon atom (atomic weight 12) and a hydrogen atom (at weight 1) vibrate in resonance as if connected by a spring. The frequency of this C-H vibration in methane is 2,915 cm^{-1} (waves per centimeter, see Fig. 1). An oxygen atom (at weight 16) will resonate with a hydrogen atom in methyl alcohol at an O-H vibration frequency of 3,683 cm^{-1}. The two carbon atoms in ethane vibrate across a single bond at 993 cm^{-1}. But in ethylene the carbons are connected by a double bond, i.e., a stronger spring. Thus the vibration is more rapid and has a frequency of 1,623 cm^{-1}.

The vibrations just described are all simple stretching vibrations. Atoms also may vibrate in such fashion that angular motion occurs and such vibrations are called deformation or bending vibrations. For example, an H-C-H or CH_2 group in aliphatic hydrocarbons has a strong deformation vibration at 1,460 cm^{-1}. Atomic groups may rotate with respect to one another thus yielding still another type of motion having a characteristic frequency. Many combinations of the above types occur to yield combination frequencies.

Any molecular vibration which is accompanied by a change of dipole moment is "infared active" and will absorb, by resonance, radiation corresponding to the frequency of vibration. Since these vibrations are characteristic of the molecule itself, the value of infrared spectrographic analysis is obvious.

The question might naturally arise as to why such a desirable analytical tool is in only limited use and at that, only for the last few years. The answer is two-fold. First, except for simple cases, it is not possible to calculate the infrared absorption exhibited by a given molecule. Samples of pure compounds must be examined to provide empirical reference spectra. But many organic compounds are difficult, if not impossible, to prepare (and retain for a moderate time) in a pure state. Secondly, the instrumental difficulties involved are enormous. The radiation is of very low inherent energy. It cannot be photographed at wavelengths longer than 12,000 A° or 1.2 microns and will not actuate photocells above about 1.7 microns. It can only be detected by tiny thermocouples, bolometers, radiometers, etc. Such instruments must detect temperature changes with a limit of error equal to, or less than, 0.00005° C. The most commonly used detector is the thermocouple. A microvolt (10^{-6} volts) output of the thermocouple must develop full-scale deflection on the recording instrument used. Since the usual resistance is only about 15 ohms and the period about 1 second, electronic amplification is difficult. Sensitive galvanometers with their accompanying vibration troubles must be relied upon. The authors know of just one case where, in the past few months, a thermocouple has been made with sufficiently small mass so that its period is faster than 1 second and electronic amplification of the thermocouple output has become possible. The spectrograph in use in the Socony-Vacuum Laboratories (Fig. 8) uses a bolometer as a detector. Electronic amplification is used and results to date indicate that this combination marks an important step forward.

Further instrumental difficulties are encountered due to the fact that only a few materials will transmit infrared radiation without selective absorption. In the wavelength region from 1 to 15 microns which supplies much useful molecular information, sodium chloride must be used for prism and windows. Since it is fairly readily attacked by water vapor it must be handled with care. Gratings are not useful for general survey work because overlapping orders of spectra are difficult to identify in this region. Even the water vapor and carbon dioxide in the air must be eliminated from the optical path through the instrument or a correction made therefor.

Despite all these difficulties, infrared absorption analyses are at present being made in several dozen laboratories. The method has proven itself an absolute necessity to any thorough investigation in organic

SUMMARY

Method—	Principal use in petroleum industry	Remarks
X-ray diffraction	Determination of the compound identity of crystalline materials, both organic and inorganic; investigation of catalyst structure.	For complete identification sample must not contain more than three or four major components. The method is not sensitive to traces. Average analysis, 5 hours required to make exposure and 1 hour calculating time.
Electron diffraction	Same as for X-ray diffraction except that only surface phenomena are detected.	Average analysis, few minutes required to make exposure and 1 hour calculating time.
Electron micrography	Extends the range of ordinary microscopy so that smaller objects can be seen. The great depth of focus reveals details which could not be seen before even at comparable magnification.	Present equipment is limited to transmission patterns. Thus the samples must be extremely thin and capable of withstanding the electron stream in vacuum without decomposing. Exposures require only a few seconds but the technique of preparing samples is somewhat tedious.
Mass spectroscopy	Determination of low molecular weight hydrocarbons.	Principally useful for mass production analysis on routine samples. Instrument time per sample is of the order of ¼ to ½ hour but calculating time to yield the final result may require several hours.
Emission spectrography	Determination of metallic elements and metalloids.	Very sensitive for determination of metals present in low concentration. Analysis time varies from a few minutes to several hours.
Ultraviolet absorption spectroscopy	Determination of aromatic and conjugated olefinic compounds.	Instrument time about ¼ hour but calculating time may require several hours.
Raman spectrography	Determination of molecular components.	Limited to hydrocarbons which do not fluoresce. Sample must not contain more than about five components. Exposures may require several hours, calculating time of the order of an hour.
Infrared spectrography	Determination of molecular components and identification of functional groups within molecules.	Sample may be a gas, liquid or solid but, if rocksalt optics are used, must not contain water. Instrument time might vary from a few minutes to 1 hour and calculating time for an average analysis probably will not exceed 1 hour. Sample must not contain more than about five components.

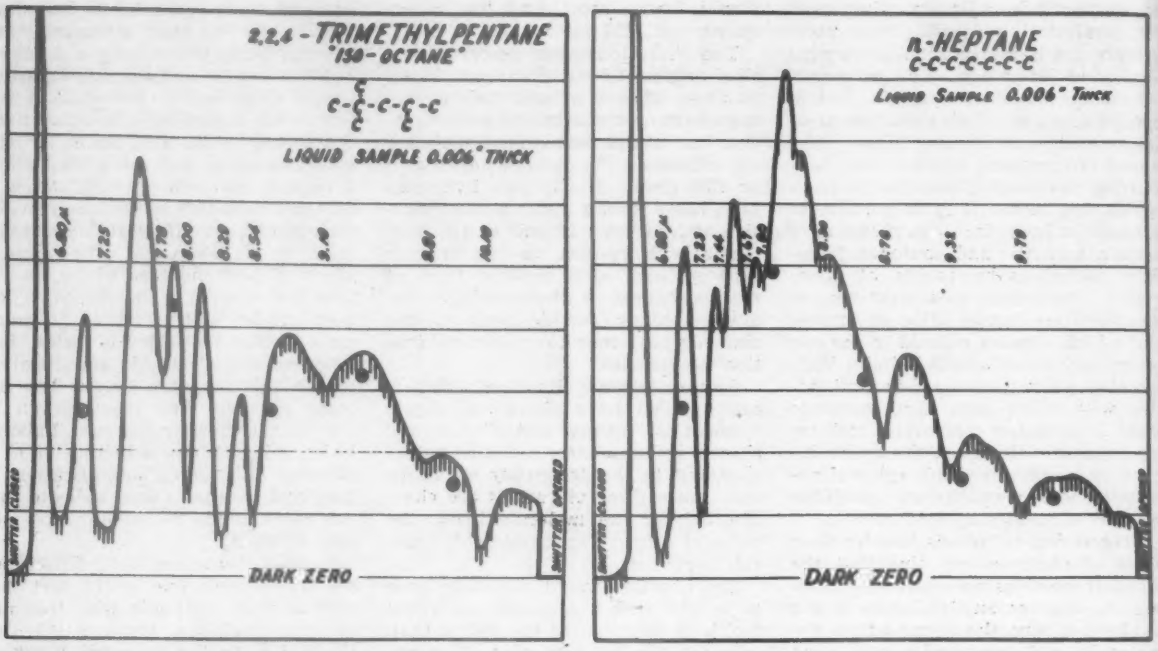

Fig. 9. Infrared Absorption Spectra: These are tracings of actual records taken by the instrument shown in Fig. 8, omitting only some of the lines on the chart paper and adding wavelength values corresponding to prominent absorption peaks. These two hydrocarbons are difficult to separate by distillation but can readily be identified by means of their infrared spectra

chemistry. Small instruments are now available from a commercial supplier. These are complete and ready to use when delivered. They do not have sufficient resolution to serve as a research tool but are capable of performing certain routine analyses which will be described in the next paragraph.

Specific uses of interest to the petroleum industry fall into two general classes. First, hydrocarbon molecules may be identified and their concentration determined by this means. In Fig. 9 are reproduced portions of the spectra of n-heptane and isooctane, two hydrocarbons which boil so close together that they are difficult to separate by distillation. With the exception of Raman spectra, the only two appreciably different properties of these hydrocarbons are their antiknock ratings and infrared absorption spectra. A relatively large amount of sample is required for a knock test but 1 cc. will suffice for infrared examination. It should be pointed out that samples presented for infrared examination must not contain too many components. The number of components which can be handled will vary depending upon the complexity of their spectra. In general, infrared analyses can most successfully be performed on samples which have been fractionated so that they contain four or less components. Specific uses of the small instruments mentioned in the previous paragraph are the determination of isobutane in mixture with n-butane and an analysis of a C_4 cut containing six components including butadiene and other unsaturates.

The second general use of infrared spectrography is for the determination of functional groups within the molecule. It was pointed out previously that C—H, O—H and C=C could be identified by means of their characteristic absorption spectra. Aliphatic C—H or C=C absorptions can be distinguished from their aromatic counterparts. However, many experimental data are needed before such determinations can be made indiscriminately. Both the intensity and wavelength of most characteristic absorptions of functional groups changes with interaction or association within and between molecules.

Once an infrared instrument is obtained, the method of analysis is relatively simple. Samples are analyzed as thin liquid films (e.g. 0.006 in.) between rocksalt plates or in the vapor phase in longer cells. Light from an electrically heated Nernst Glower or Globar is allowed to pass through the cell, focused and directed by mirrors and dispersed into a spectrum by a rocksalt prism arranged as a monochromator. This spectrum is examined point by point by the thermocouple or bolometer detector and usually recorded on chart paper. The various molecular components in the sample absorb light at specific wavelengths and thus may be qualitatively identified by comparison with known reference data. Quantitative data can be obtained by comparison of the intensity of absorption at suitable wavelengths with known mixtures or, in some cases, by calculation for which only the spectra of the pure compounds need be known.

Buried Transport

War has promoted the art of transporting commodities without use of wheels, wings or hulls, according to V. C. Jones in the Wall Street Journal.

Pipe lines are buried deep in history. It was about 2,000 B.C. that Minos, priest-king of Crete, laid pipe from springs in the neighboring hills to foot-baths and drinking fountains in his palace at Knossos. Early settlers in this country built lines of hollowed cedar logs. Natural gas first was piped from a 27-ft. well to a reception given for LaFayette at Fredonia, N. Y., in 1824 (but this setup was quickly destroyed because of "offensive odor").

Today pipe lines are a foundation for America's industrial and military might. The Federal Power Commission recently approved a 1,200-mile natural-gas line from Corpus Christi, Tex., to Cornwall Station, W. Va. (Tennessee Gas & Transmission Co.). It will have a capacity of 200 million cubic feet a day. Measured in terms of household needs, through this pipe in 1 year will pass enough gas to keep a burner on the ordinary cooking stove burning for 5½ million years, to boil 24.3 billion kettles of water, to fry 73 billion eggs.

The major gas line will use more than 200,000 tons of steel.

RISING DRILLING COSTS REQUIRE EXAMINATION OF EXPENSE ITEMS

INCREASED drilling costs during the past year have caused both drilling contractors and oil operators to examine closely all expense items. Contractors have reported that drilling time has shown a decided upward trend over that of a year ago. In general, these increased drilling costs can be traced to shortage of trained personnel, lowered efficiency and increase in cost of materials.

Since the initial drilling cost represents an investment which ordinarily must be recovered over years of operation, any increased expense in this direction is particularly alarming to the oil operator.

Increased drilling costs are of equal importance to the drilling contractor who must estimate future costs with a fair degree of accuracy to make a profit. Although several years ago bids were made on the basis of very few past records, the increasing complexity of drilling operations has made cost accounting of vital concern to the drilling contractors.

Breakdown of Drilling Costs

A complete breakdown of drilling costs may be made in a number of different ways and probably no standard method of cost analysis is used by the contractor. An increase in number of records has been made necessary by federal and state regulations. However, a complete breakdown of drilling expense is useful only as a means for keeping track of where the dollar is spent and as a basis for estimates on future bids.

A general outline for segregation of drilling expense is shown in Table 1. It will be noted that, in general, this outline follows the classical accounting system of labor, materials, repairs, depreciation, etc. Although this cost record system has been found satisfactory for segregation of expense into definite and recognized brackets, it may present a disadvantage for analysis of actual drilling operations, where fishing time, percentage of time on bottom, etc., are to be considered.

Analysis of Costs

To estimate drilling costs for bidding purposes the operator of the rig must rely largely on past records. Most operators have a clear idea of future costs which will be incurred. These costs are frequently based on either a "total-cost-per-day" or a "total-cost-per-foot" figure. Although the total cost per foot is used as a basis for "per foot" contracts, such an estimate does not always reflect the contractor's expense. Usually, the actual cost to the contractor is incurred on the basis of time spent at the location in drilling operations. On the other hand, analyses based on "per day" operation may prove deceiving unless the effects of lowered efficiency and longer drilling time are considered.

An example of costs computed both on a day basis and footage basis is shown in Table 2. The actual drilling expense, including all direct and indirect charges for four different rigs on the basis of past records, is shown in the first column. Analyses indicated that the drilling time had increased approximately 11.5 per cent over that of 1 year ago. The cost per foot and total drilling cost on both a 25 and 29-day basis for a 4,000-ft. well have been calculated and are shown in the remaining columns.

In general, oil companies operating rigs and drilling contractors have both reported a steady increase in per-day costs for rigs. In some instances, a cost analysis reveals that an increasing amount of expense is being incurred by inferior equipment and substitutions.

In addition to the increased per-day drilling expense, increased drilling time raises the per-foot drilling expense to a still higher level and both of these factors must be considered in determining the amount of profit to be made.

TABLE 1—DRILLING COSTS

Labor:
- Rigging up
- Rig floor
- Subcontract

Supervision—direct charges

General expense—auto and overhead (direct charges)

Operating repairs:
- Drill pipe shop
- Bits, reamers
- Fishing tools
- Hose
- Rotary chain
- Wire line
- Engines and boilers
- Valves, fittings, etc.
- Pumps
- Miscellaneous

Hauling and freight

Materials:
- Fuel
- Water
- Mud materials and reagents
- Oil and greases
- Lumber
- Cement
- Miscellaneous

Depreciation:
- Rig
- Drill pipe
- Other

Taxes, insurance, interest:
- Compensation and liability insurance
- Fire, boiler and other insurance
- Interest

Administrative—general office, clerical, etc.

TABLE 2

Drilling cost per day	Cost per ft. 25-day basis	Cost per ft. 29-day basis	Total cost 25-day basis	Total cost 29-day basis
$532	$3.32	$3.85	$13,280	$15,400
573	3.75	4.15	14,200	16,600
511	3.19	3.70	12,750	14,900
622	3.88	4.50	15,530	18,000

CREAM DETERMINES *The Value*

The primary value of milk is in the butter-fat. Skim off the cream and all you have left is just plain blue milk. It still has value — but it has been considerably depreciated. ☆ The same thing happens to petroleum stored at atmospheric pressure. The volatile gases quickly evaporate — you'd be surprised how quickly. According to data presented to the A.P.I., a 55,000-barrel storage tank of standard steel deck construction with open vents, filled with mid-continent gasoline, evaporated 7 barrels daily . . . or 4.7% of the volume stored per year. Figured at 3¢ per gallon, 42 gallons per barrel, that's a daily loss of $8.82 — or an annual loss of $3219.30 ☆ This loss could be reduced about 49% by making the tank gas tight and holding it under 0.9" water pressure or vacuum, thereby reducing the loss to $1577.46. The necessary S. & J. Gas Tight Fittings would cost about $400.00 — an investment that would pay a 400% dividend.

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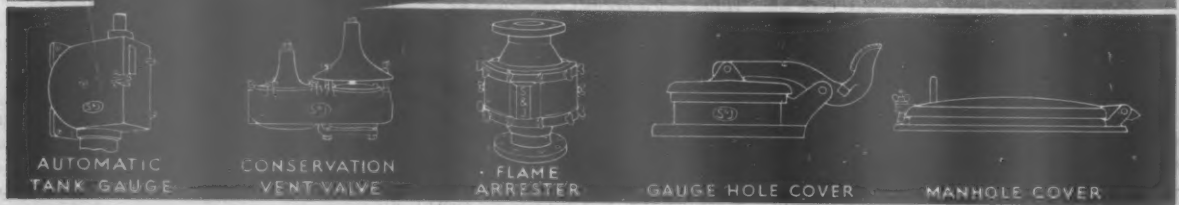

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SHAND & JURS

Engineering Fundamentals

No. 120

A WEEKLY FEATURE OF THE OIL AND GAS JOURNAL

VISCOSITY OF DRILLING FLUID

ANOTHER very important property of drilling mud is its viscosity. The term viscosity as applied to any fluid represents its internal resistance to flow. A fluid having a high viscosity offers greater resistance to flow than does a fluid of lower viscosity. Water flows with greater ease than does a clay suspension in water (such as drilling mud), and thus the clay suspension is said to have the higher viscosity.

Ordinary fluids (such as water, oils, glycerin, etc.) have a definite constant viscosity at any given temperature. However, a colloidal suspension of the type characterized by certain drilling fluids does not have a constant viscosity at constant temperature. The viscosity of such a drilling fluid varies with the rate of agitation. When circulated at low rates of flow the fluid exhibits a higher viscosity than when circulated at higher rates; when allowed to remain undisturbed for a period, the apparent viscosity of the drilling fluid becomes even greater than at the low rate of flow. A mud exhibiting this property of a variable apparent viscosity which decreases as the rate of agitation of the fluid is increased is said to be thixotropic, or to possess gel properties. The practical significance and measurement of gel properties will be discussed in greater detail in a later installment of this series.

The primary function of viscosity is to enable the mud to properly remove the cuttings from the hole. This requires that the viscosity be above a certain minimum value for a given upward velocity of mud circulation. Water, rather than mud, can be used as the medium for carrying rotary drill cuttings to the surface; but if water were used, the upward flow of the water would have to be at a greater velocity than that of mud.

The carrying capacities of clay drilling fluids are difficult to evaluate by mathematical calculations because of the gel properties which have already been mentioned. As an example of the rate at which water would have to be circulated to remove cuttings, Rittinger's formula may be applied. This formula is as follows:

$$v_s = 7.1 \frac{d\,(\rho_1 - \rho_2)^{1/2}}{\rho_2}$$

Where

v_s = velocity of slip, ft. per second.
d = diameter of cutting, ft.
ρ_1 = density of cutting, lb. per cu. ft.
ρ_2 = density of water, lb. per cu. ft.

This formula is based upon turbulent flow of the water and applies to cuttings approximately spherical in shape. For flat particles the same formula may be used if the constant 5.2 is substituted for the constant 7.1.

Example

Problem. — Calculate, using Rittinger's formula, the rate at which water must be circulated when drilling 8½-in. hole using 4½-in. o.d. drill pipe in order to carry round cuttings of 0.01 ft. diameter and 2.5 specific gravity to the surface.

Solution.—For substitution in Rittinger's formula the various terms are as follows:

$d = 0.01$ ft.
$\rho_1 = 2.5 \times 62.4 = 156$ lb. per cu. ft.
$\rho_2 = 62.4$ lb. per cu. ft.

Substituting these values into the formula:

$$v_s = 7.1 \frac{0.01\,(156 - 62.4)^{1/2}}{62.4}$$

$= 0.867$ ft. per second

The cross-sectional area of the annular space between the 4½-in. o.d. drill pipe and the 8½-in. hole* is calculated as follows:

$$A = \frac{0.785\,(8.5^2 - 4.5^2)}{144} = 0.2835 \text{ sq. ft.}$$

Then, since the upward velocity of the water in the annular space must exceed the velocity of slip of the cutting which it carries, the minimum rate of water circulation required for the given case would be:

$$Q = AV = 0.2835 \times 0.867 \times 60$$
$= 14.75$ cu. ft. per minute.

This would be equivalent to 14.75 × 60/5.62, or 157.5 bbl. per hour. A much lower rate of circulation is adequate when a colloidal clay suspension, rather than water, is used as the drilling fluid.

Upper Limit of Viscosity

The upper limit of mud viscosity is determined by the pumpability of the mud. That is, if the viscosity is allowed to become too high, circulation cannot be maintained without exceeding the maximum allowable working pressure of the slush pumps and surface mud connections between the pumps and the drill pipe.

If the viscosity is allowed to become too high, gas from the formations drilled may become entrapped in the mud and will not be released at the surface. Such a mud is said to be "gas cut." Serious blowouts have been caused by the lightening of the mud column in a well due to the expansion of occluded gas bubbles near the top of the hole and expulsion of mud from the hole to a sufficient degree that the pressure in the gas sand blows all the mud above it bodily out of the hole.

A mud of too high a viscosity may lead to a blowout because of the swabbing action when pulling the drill pipe from the hole. Such swabbing results from the fact that the mud is so viscous that it will not completely run past the drill collar and bit as they are removed. As a consequence, the pressure exerted by the mud column against the bottom of the hole is lowered so much that a blowout occurs.

If the mud viscosity becomes too high, sand and similar coarse and abrasive material brought to the surface in the stream of mud may not be easily removed in the pits. The recirculating of such sand is undesirable because of the excessive wear that it causes in the pumps, pipe, swivel, and other equipment.

*In this solution the assumption is made that the hole is not enlarged by caving to any greater diameter than that drilled by the bit.

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Series prepared by Glenn M. Stearns, associate professor of petroleum engineering, University of Oklahoma

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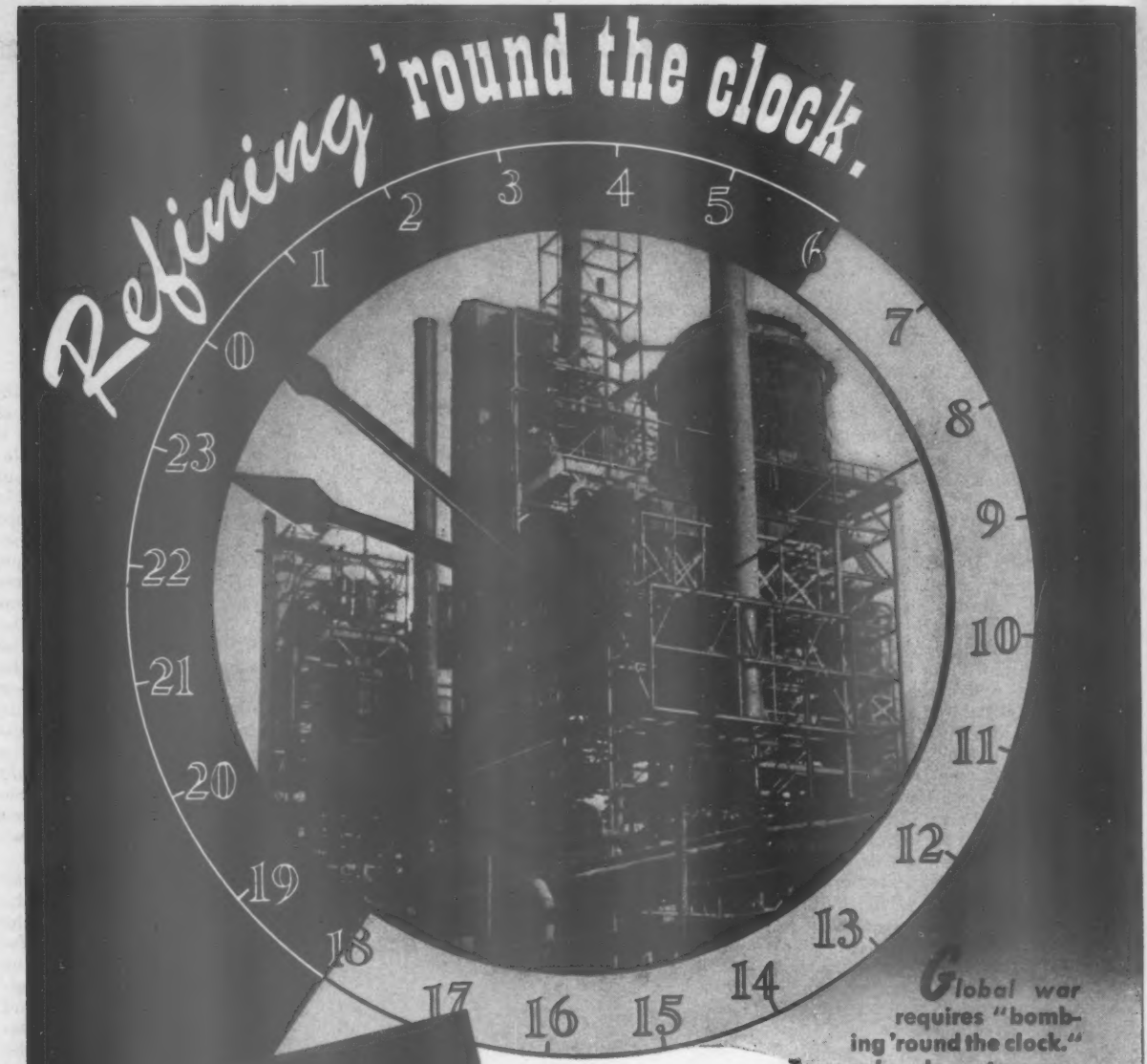

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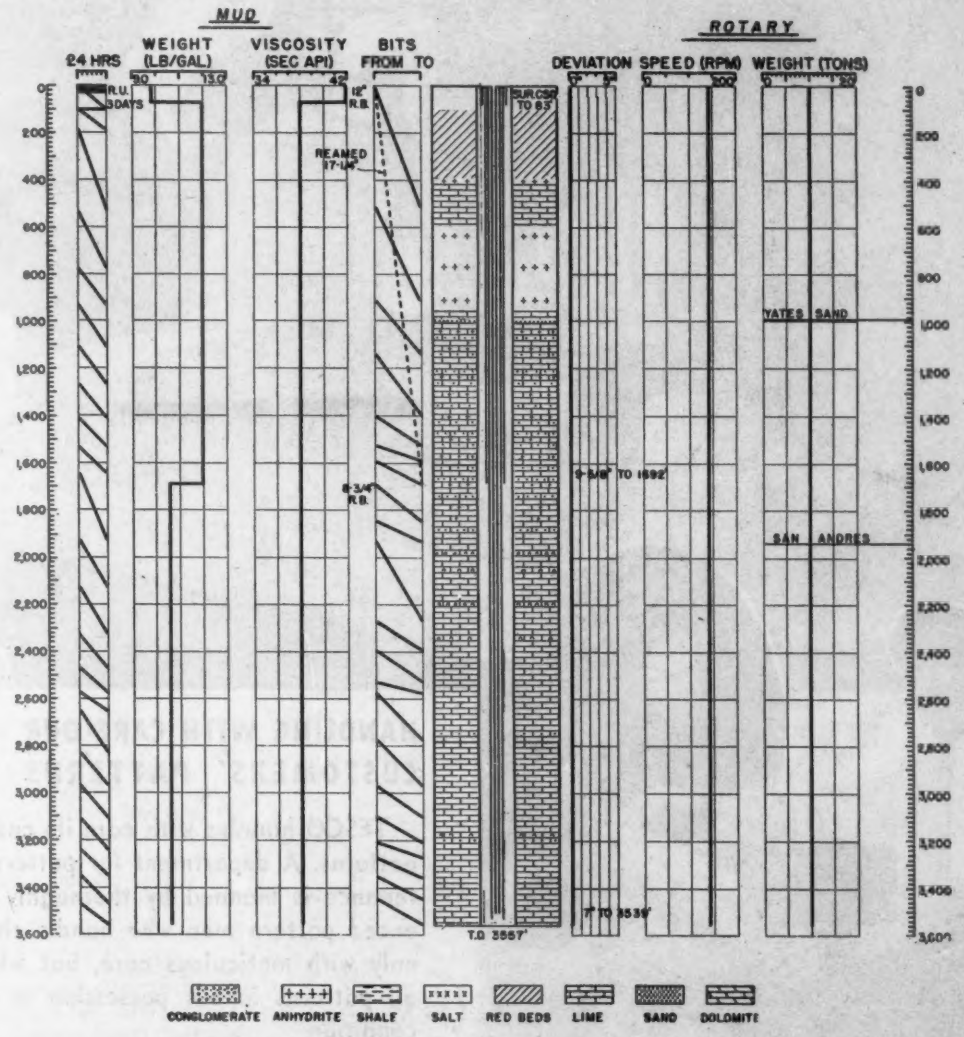

DRILLING TIME

	Days
Drilling	17½
Running surface casing and WOC	2½
Circulating	7
Shut down for orders	1
Shut down for repairs	3
Trips	3
Running oil string and WOC	4
Completing	15½

BITS USED

Type—	Number	Size (in.)
Drag bit	1	17¼
Rock bit	7	12
Rock bit	14	8¾
Rock bit	2	6¼

CASING AND TUBING RECORD

Size (in.)	Weight (lb.)	Depth (ft.)	Cement (sacks)
13¾	61	83	100
9⅝	36	1,892	600
7	22	3,539	250
2½		3,530	

MUD USED

Type—	Tons
Marco clay	9
Aquagel	2
Zeogel	2
Exmix	2
Crane clay	3

COMPLETION

Gun perforating (hr.)	18
Size shots (in.)	15/32
Number shots	5
Acidizing (hr.)	8
Amount acid (gal.)	500

PRODUCTION TEST

Time flowed (min.)	22
Choke (in.)	¼
Oil (bbl.)	63.18
Gravity, corrected	21.8
Bottom-hole pressure (lb.)	1,701
Bottom-hole temperature (deg.)	88

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REFINING

Alcohol-Blend Proponents Launch Extensive Inquiry

WASHINGTON, D. C. — Another determined effort to promote acceptance of grain and wood alcohol as a component of motor fuel is presaged by last week's announcement that Senator Gillette's agricultural subcommittee will soon start an exhaustive investigation of the question.

Gillette declared that preliminary inquiries indicated American oil companies belittled the alcohol blend in this country while "lauding its merits abroad."

The committee, seeking to stimulate production of alcohol from farm and wood products to meet synthetic rubber and other war needs, Gillette said, has run up against what he called the antagonism of "monopolistic interests" in the 2 years of its existence.

"It is interesting to note that some of the large petroleum interests have consistently ridiculed the use of alcohol blended with gasoline as a motor fuel when some of these same companies were the principal buyers of Polish alcohol from the Polish Government before the German invasion," he said.

Asserting additional funds would be sought to continue the over-all inquiry in 1944, Gillette asserted it had forced expansion of the synthetic-rubber program through the use of grain alcohols to supplement petroleum processes.

"We feel this opposition is motivated by selfish purposes designed to control the huge markets for these products monopolistically."

Attempts of the agricultural bloc to enact legislation compelling distributors of motor fuel to blend 10 per cent of alcohol from grain products in finished gasoline were frustrated because it was proven that costs were excessive so long as ample petroleum was available.

Labor Board Grants Union Checkoff at Quaker State

PHILADELPHIA, Pa.—Checkoff of union dues and standard voluntary maintenance of membership were granted last week by Regional War Labor Board to Local 381, Oil Workers International Union (C.I.O.) for 129 employes at Quaker State Oil Refining Co.'s Emlenton, Pa., plant.

Making Big Contribution to Synthetic-Rubber Output

BEAVER FALLS, Pa.—One-seventh of the country's production of butadiene and styrene, chief chemical constituents of synthetic rubber, is now coming from the 200-acre Kobuta plant of Koppers United Co. in Beaver County, near here, which has been put on full-scale operation.

"This is one of the outstanding plants of its kind in the United States—plants that are doing so much to relieve the acute rubber shortage," said Bradley Dewey, rubber administrator, following an inspection tour. He and other officials of War Production Board and Rubber Reserve Co. visited the brick and reinforced-concrete buildings, big processing units, and pressure storage tanks—all designed to produce 117,500 short tons of butadiene and styrene annually for shipment 100 miles away to Akron, Ohio, for conversion into synthetic rubber.

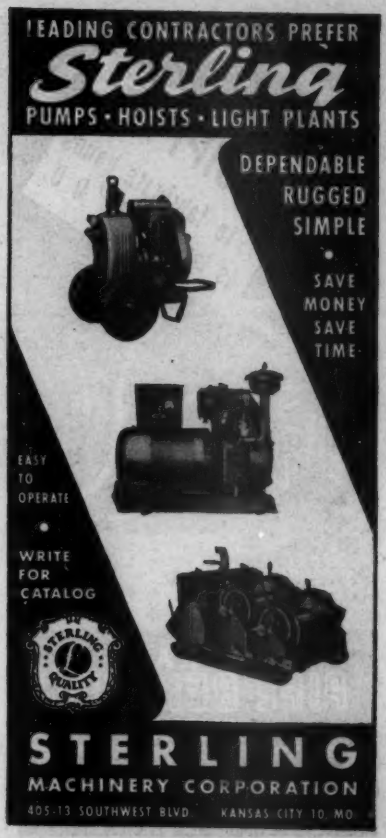
Dan M. Rugg, vice president of Koppers, told of the nearly 100 million gallons of alcohol, 12 million gallons of benzine, billions of gallon of water and immense quantities of coke used here annually to be transformed by the buna-S method into tires for jeeps and airplanes and other war implements.

Only 1,000 employes, 35 per cent of them women, operate this highly mechanized and functionalized plant, a surprisingly low number, Rugg said, in view of the output.

Motorists May Look for Cut In 1944 Gasoline Supply

WASHINGTON, D. C.—With the refinery output of gasoline going primarily to meet the needs of stepped-up military operations, the country's motorists face the likelihood of further cuts in their fuel supplies. Officials of Petroleum Administration for War say they see no possibility of increasing existing low allotments for civilians. Their most optimistic prediction is that there will be no cut during the first 3 months of the year.

Over all hangs the possibility of emergency curtailment of home-front



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driving to meet military demands for the expected Allied invasion of Europe. Officials believe, however, there will be no recurrence of the emergency ban on pleasure driving and stiff ration cuts that followed the invasion of North Africa in 1942.

Octane Decline Shown by Bureau of Mines Check

WASHINGTON, D. C.—The average octane number of domestic motor gasoline declined slightly during the summer of 1943 under the strain of war-time diversions to the armed forces, according to a Bureau of Mines survey report released last week.

Based on analysis of 775 service station samples representing the products of approximately 77 oil companies, the report disclosed that the average octane number of premium-priced gasoline had dropped from 79.6 to 79.1 since the last survey was made during the winter of 1942-43. Similarly, average octane numbers decreased from 72.5 to 72.0 for regular-price gasoline and from 63.1 to 61.2 for third-grade gasoline during that period. No report was made during the summer of 1942, but comparable octane numbers for the summer of 1941 were premium-price grade, 80.2; regular, 74.7, and third grade 63.9.

Diversion of high-quality crude oils to the production of aviation gasoline accounts in large measure for the declines.

Inaugurated in 1936, the survey reports are published semiannually in cooperation with the Coordinating Fuel Research Committee. Petroleum companies marketing in the Pacific Coast region are represented by separate data averaged by the Pacific Coast Technical Group and published as submitted.

All Restrictions on Asphalt Are Removed in Canada

OTTAWA, Ont.—All restrictions on the purchase and use of asphalt have been removed by the Dominion fuel controller. It was explained that crude oil for refineries available or in prospect for 1944 is of a type which produces a larger percentage of residual heavy fuel oil and asphalt. Production of lighter products is expected to remain short of demand.

Sketches of Plant Operators

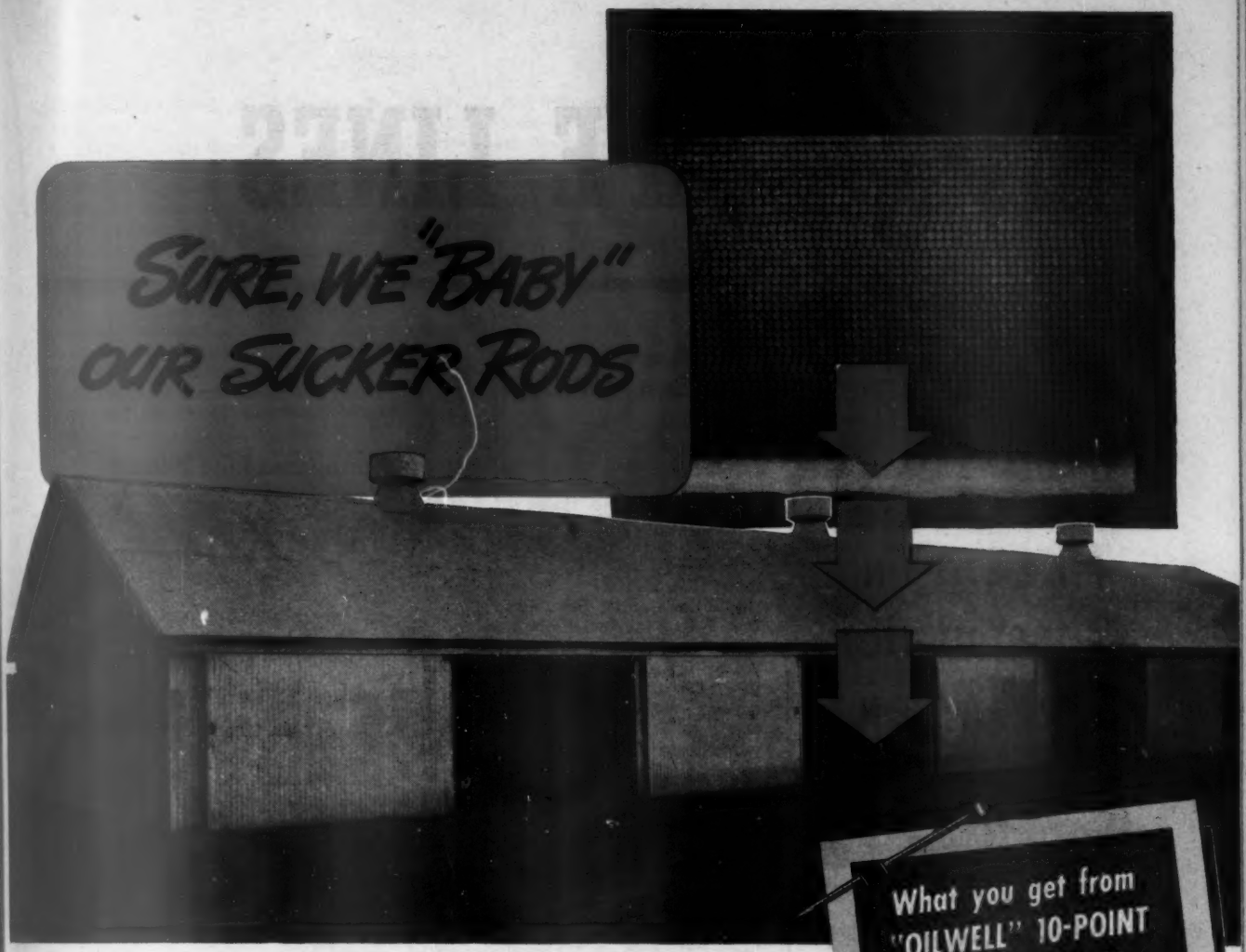
W. L. LINTON, superintendent of the Sone and Fleming (Brooklyn, N.Y.) refinery of the Socony-Vacuum Oil Co., Inc., since 1938, joined Socony as a research chemist in 1920 after receiving his Ph.D. degree from the Johns Hopkins University.

During the last war, his researches led to the discovery of a means by which CO. could be oxidized to CO_2 at atmospheric temperatures and pressures using a finely dispersed metallic oxide as a catalyst. Later, he improved the efficiency of a commercial catalyst used in the fixation of atmospheric nitrogen.

He subsequently became the head of two sections in what is now the Technical Service Division of the company's general laboratories at Brooklyn and during the last 6 years of that employment was in charge of the division. He played a major part in organizing and directing the activities of the Products Development Group. In this capacity, he became familiar with the technical people and operations of practically all of the major industries throughout this country, and also became intimate with the lubricating and process products requirements of every marketing division of the company.

He served as chairman of the lubricating oil and grease committee of the company's manufacturing department, as well as on several other committees relating to these products and asphalts within the petroleum industry. He is chairman of the company's committee on the manufacture of specialties.

Some of his civic interests include membership in the Greenpoint Y.M.C.A. and Chamber of Commerce; chairman of the industrial salvage committee for the coal, wood and petroleum products industries for New York City. He also served for 2 years on the Brooklyn council as chairman of the Brooklyn petroleum section of the Greater New York Fund.



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WEP Prepares to Test 20-in. East of Wabash

Preparations are being made for applying pressure tests to War Emergency Pipelines, Inc.'s 20-in. products line in a section east of the Wabash River, across the states of Indiana and Ohio. To do this water will be pumped as far as the Ohio River. It is believed likely that the initial shipment of products may be pumped into the 20-in. line at Beaumont, Tex., at the end of this week.

Eight stations are expected to be ready for operation east of Norris City, Ill., some time this month. To furnish protection where pipe appears to need it in the vicinity of pump stations, half soles are being welded over longitudinal seams for distances of 400 ft. on suction and discharge lines.

A "loud voice" communication system has been installed for the WEP 24-in. crude-oil line to displace teletype equipment. The only loud speaker to be installed in connection with this as yet is in the dispatcher's office at Cincinnati. While the organization is waiting for loud speakers to be installed at each station, the new system is functioning satisfactorily by the use of head telephones only.

Military Pipe Line in Burma Is Planned

A pipe line of unannounced capacity to be built in Burma was mentioned by Lieut. Gen. Brehon Somervell, commander of Army Service Forces in the course of testimony presented recently to the Truman committee. He also referred to a pipe line under construction in Italy as well as one in service in Africa.

Southwest Emergency Line Handles Large Shipments

Defense Plant Corp.'s Southwest Emergency Line has been moving large volumes of crude oil from the Corpus Christi area to Houston. This line consists of 150 miles of 14-in. and 16-in. which was reconditioned and converted from natural gas to crude-oil service in the last half of 1943. Extensions to the gas line were laid from Refugio and Pierce Junction. Average daily shipments were as follows: Week ending December 15, 71,661 bbl.; December 22, 71,505 bbl.; December 29, 69,360 bbl.

Tennessee Line Benefits Explained at Hearing

Witnesses for the Tennessee Gas & Transmission Co. testified last week before the Texas senate investigating committee at Austin, Tex., that its 1,188-mile pipe line from South Texas to West Virginia is a necessity of war, that it will add $50,000,000 to Texas assets, and that instead of there being gas wastage there will be conservation.

Gardiner Symonds, president of the Tennessee company, declared that contracts covering $40,000,000 of the estimated $48,000,000 cost of the line have been let, that construction is proceeding rapidly at river crossing and compressor stations and that the

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24-in. pipe is being produced for the line.

Symonds said that 300 gas fields already have been found in Texas within 100 miles of the proposed route. An extension of its gathering facilities from the Agua Dulce-Stratton area near Corpus Christi to the lower Rio Grande Valley is contemplated for the postwar period.

He described the Tennessee company as desiring to become a part of Texas and said it considered itself a Texas industry. It now has 300 employes in the state and contemplates having a permanent staff of 600 to 700 persons.

"Most of the gas will go into war industries," Symonds said. "We will pay 5 cents per 1,000 cu. ft. for all gas we buy, or that will be the average, and this is higher than the average price over Texas. At the West Virginia terminus we will be paid 21 cents per 1,000 cu. ft. The Texas reserves are fully adequate for our plans.

"Taking out this gas will in no way endanger oil developments in Texas, for the Chicago Corp. itself has an investment of $10,000,000 in a recycling plant in South Texas and it would certainly do nothing to injure itself."

Symonds told the committee that when the Federal Power Commission and the WPB had granted permits and priorities, protests were made by railroads, railroad employes and coal associations, but that all this opposition disappeared when the war benefits of the project were established.

"No one questions the need of this pipe line for the war industries," Symonds testified, "and great speed is necessary for the WPB wants this line completed during the present year. There is a gas shortage in the Appalachians that is worrying war industries there and the Texas gas is needed so they may continue to operate. Coal industries are unable to cope with the increasing war demands."

OPA Regulates Used Valve Transactions

Moving to restore the normal price relationship of used and reconditioned valves within the industry and to halt the sale of used valves as reconditioned valves, the Office of Price Administration established a method of price computation for both types.

This was accomplished by Amendment 69 to Revised Supplementary Regulation 14 to the General Maximum Price Regulations effective December 29, 1943. The maximum price for any reconditioned valve shall not be in excess of 80 per cent and used valves 40 per cent of either the original manufacturer's net price to jobbers for the new valve or any other manufacturer's net price to jobbers for a new valve of identical type. These prices are f.o.b. the seller's place of business except that no additional charge may be made for local delivery if a free delivery was maintained by the seller during the month of March 1942.

Laying of Stanolind 16-In. Line Progresses

More than 107 miles of 16-in. line had been laid up to last week in the construction of Stanolind Pipe Line Co.'s 385-mile 16-in. line from West Texas; 338 miles of pipe had been shipped from the mills. At station sites work is well advanced in the laying of conduits and building of foundations and cottages.

River crossing crews have been doubled to four.

Severe snow storms during the past week retarded progress of construction in West Texas. As a result, contractors' work which had been scheduled for completion March 1 may be delayed as much as 10 days. Operation of the line had been planned to start April 1.

Laying of Sinclair's Toledo Line Is Near Completion

Laying of pipe for Sinclair Refining Co.'s 250-mile 8-in. from East Chicago, Ind., to Toledo, Ohio, is 95 per cent completed. Buildings at Toledo are 30 per cent completed. Approximately 5 per cent of equipment installation has been completed. Sixty per cent of the tankage has been erected.

Zenith Gas Enlarges Pipe-Line Facilities

Zenith Gas Co., which serves Oklahoma communities, including Woodward, Cherokee, Alva and others, has completed the relaying of 8 miles of pipe line which increases the gas flow 1,000,000 cu. ft. daily. The company gets its gas supply from wells southeast of Medicine Lodge, Kans. Four miles of 6-in. pipe have been replaced with 8-in. south of the Kansas border, and the 6-in., thus taken up, has been looped with 4 other miles of 6-in.

Gulf Plans Looping West Texas Outlet

Application of Gulf Refining Co. has been presented to the War Production Board to loop its line from West Texas to Weatherford, Tex., then to Saltillo, Big Sandy and the WEP 24-in. at Longview, Tex. The application for 48 miles of 10-in. pipe would give the Gulf two 10-in. systems from West Texas and boost its capacity 16,000 bbl. daily.

Independent Natural Withdraws Texas-Wisconsin Application

WASHINGTON, D. C.—The Federal Power Commission last week permitted the Independent Natural Gas Co., a Phillips Petroleum Co. affiliate, of Bartlesville, Okla., to withdraw its application to build a natural gas pipe line from Ray, Tex., to Milwaukee, Wis. The company, which asked on February 28, 1942, for authority to construct and operate the pipe line, said it now believes construction of the 877-mile system would be currently impractical.

Stanolind's Elk Basin Outlet May be Started in June

Although pipe may be arriving as early as April and May for Stanolind Pipe Line Co.'s Elk Basin-Casper, Wyo., crude-oil line, the lateness of good construction weather in the Rocky Mountains is likely to mean that laying of pipe will not begin before June. The project is scheduled for completion by September 1. Cost is estimated at $4,200,000.

This 230-mile line of 8-in. and 10-in. pipe will be equipped with two stations for initial operation with capacity of 21,500 bbl. daily to Casper. Later this capacity could be increased to 44,000 bbl. daily by building additional pump stations.

Missouri-Kansas Directors Urge Unity in Management

Seven directors of the Missouri-Kansas Pipe Line Co. (Mokan) announced today they had sent letters to stockholders urging them to stand by the company's present management, headed by President William G. Maguire.

The directors—Hubert E. Howard, Ira L. Letts, Charles E. Main, Geoffrey R. Mellor, John R. Perry, William G. Tringham and Winslow B. Van de Vanter—told the stockholders their company had a net worth of $8,676,288 when Maguire became president 3½ years ago, and that now its worth had risen to $20,779,241.

A group of stockholders headed by Arthur G. Logan, Richard B. Hand and A. Faison Dixon, has sought to oust the Maguire management, and as a result Mokan announced recently it was considering dissolution.

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SHIPBUILDING COMPANY

ORANGE TEXAS

Natural Gas

Columbia Assists Four Gas And Gasoline Subsidiaries

PHILADELPHIA, Pa. — Securities and Exchange Commission last week approved the proposal of Columbia Gas & Electric Corp. to make capital contributions aggregating $9,313,372 to four oil and gasoline subsidiaries acquired from Columbia Oil & Gasoline Corp.

Income demand notes totaling $662,416 for Ohio Fuel Supply Co., $4,944,117 for Preston Oil Co., $44,812 for Viking Distributing Co., and $3,662,027 for Virginia Gasoline & Oil Co. will be canceled.

No Gas for Repressuring Oil Fields if Shortage Grows

OKLAHOMA CITY, Okla.—If the natural-gas shortage becomes acute, use of that commodity for repressuring oil fields will be forbidden, it was disclosed at a hearing before Corporation Commission here last week. There already have been curtailed deliveries to some of these projects in Oklahoma, it was said.

The South Burbank field repressuring project was under discussion in connection with the application of Cities Service Gas Co. for permission to increase its withdrawals from West Cement field to meet weather emergencies. Available gas produced with the oil is used, but in addition Cities Service has delivered up to 11,000,000 cu. ft. of gas a day to the project.

At present the project is receiving about 6,500,000 cu. ft. daily, owing to prorated restrictions already in force. South Burbank produced a daily average of 6,849 bbl. of oil during November and is holding near that rate.

One of the most successful deep repressuring projects in the state is in the south end of the Oklahoma City Wilcox zone, where leases in two sections have been unitized for several years.

Army and Navy E Awarded To Two Helium Plants

WASHINGTON, D. C.—In recognition of records made in production of helium for antisubmarine blimps, barrage balloons, and other war materials, two helium plants of the Bureau of Mines have been awarded the Army and Navy "E."

"By working night and day, 7 days a week, the Amarillo (Tex.) helium plant and the Exell (Tex.) helium plant have met every requirement of the Navy and the Army for this valuable, noninflammable gas," Harold L. Ickes, secretary of the interior, said, "and have been able also to satisfy the needs for related war uses and essential civilian activities."

Ickes paid special tribute to employes whose specialized knowledge and skill in supervision and operation of the two Texas plants have enabled the department to increase the production of helium above expectations, the output having risen to more than 25 times that of prewar days.

Despite the dawn-to-dawn work schedule, and the 7-day work week, the Amarillo unit reported only 2.06 per cent absenteeism among its employes, and the Exell plant only 1.626 per cent.

Royalite Forms Subsidiary to Handle Turner Valley Gas

CALGARY, Alta.—Royalite Oil Co. has incorporated a new subsidiary, Madison Natural Gas Co., Ltd., to handle sales of gas produced in Turner Valley to the Canadian Western Natural Gas Co. of Calgary. It is understood the plan is to segregate the natural-gas business from the other activities of Royalite, with a view to facilitating new conservation measures planned by the Alberta government for the Turner Valley field.

Texas Gas Reserves Estimated at 100 Trillion

AUSTIN, Tex.—The South Texas gas industry already is being benefited by the projected Tennessee Gas & Transmission Co. pipe line from Nueces County, Texas, to West Virginia, gas well owners told a Texas Senate investigating committee here last week.

Several operators told the committee of unprofitable dealings in gas production, of selling gas for less than 1 cent per 1,000 cu. ft. and of heavy gas production abandoned for lack of market outlet. Now, they said, prospective purchasers are interested in acquiring gas properties.

E. O. Bennett, Houston, Tex., petroleum engineer, summoned by the committee, estimated that present proven Texas reserves of natural gas are 100 trillion cubic feet, and that even with withdrawals increased 270,000,000 cu. ft. a day for the new line, an adequate supply would be assured present customers for at least 50 years. Bennett said that natural gas is being recognized as an increasingly valuable resource.

Gardiner Symonds, president of the Tennessee company, testified that his firm had had contracts with the Chicago Corp., an investment concern which is the principal stockholder of Tennessee Gas & Transmission Co., which would insure a supply sufficient to furnish 270,000,000 cu. ft. of gas daily starting next winter to customers in the West Virginia industrial area. The corporation owns extensive gas production near Corpus Christi. It is the pipe line company's intention, Symonds testified, to buy gas from producers other than the Chicago Corp. on contracts starting at 5 cents per thousand and increasing 1 cent per thousand each 5 years until an 8-cent level is reached.

Symonds declared that the Chicago Corp. pioneered in Texas recycling of gas, by which liquid hydrocarbons are removed and the dry (methane) gas returned to the reservoir for storage until it is needed as fuel. He said the concern has $10,000,000 invested in Texas recycling plants, removing 8,000 to 9,000 bbl. of liquid daily, of which 71 per cent goes into making aviation fuel. With further technological advances, Symonds said, the company also hopes to sell propanes and ethanes which it now is returning to the reservoir.

"It would be foolish to think of doing anything detrimental to the oil and gas industry in Texas in view of investments here," said Symonds.

L. B. Herring, Corpus Christi, Tex., consulting geologist, estimated Gulf Coast proven reserves at 40 trillion cubic feet, but declined any forecast for the remainder of Texas. He foresaw very substantial production in the Panola County-Carthage field gas area and said the Panhandle field's reserve now is rated twice as high as when the field first was tapped.

The final witness, Dr. E. P. Schoch of the University of Texas emphasized under crossexamination by Attorney Clint Small for the Tennessee company, that he never had said anything in regard to the question of gas exploration except "Let's study this matter."

In reply to a question from Senator Fred Mauritz of Ganado, member of the committee, Schoch said he felt the state should not lock up its supply of natural gas.

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Exploration and Drilling

Week's Highlights

PRELIMINARY production tests and indications of commercial possibilities disclosed by formation samples in widely scattered exploratory operations this week indicated that the accelerated wildcat drilling program desired both by industry and Government is off to an uncommonly fast start. The customary lag of drilling in the first 2 or 3 weeks of the year is absent this January largely because of the momentum carried over from the final quarter of 1943.

Included in the week's outstanding developments were: An indicated new discovery in the Frio-Vicksburg trend in eastern Jim Wells County, Texas; showing of oil from the Devonian in a Winkler County, West Texas, deep test originally scheduled to the Ellenburger; oil-stained cores from the lower Wilcox and Hunton lime in deep tests in McClain County, Oklahoma; and the possibility that flanks of the extensive Carthage gas field in Panola County, East Texas, will prove productive of oil from the Cotton Valley formation.

From a standpoint of tangible evidence, the development of recent weeks in the Frio-Vicksburg trend may be classified as outstanding. A vast scope of territory is apparently opened to more intensive exploration by the discovery of oil in the Vicksburg 4 miles northeast of the old Alta Mesa shallow field in Brooks County. The general area was maintained in the spotlight this week by indications of another new field 3 1/2 miles east of Seeligson, near the Kleberg line.

Significance of the showing from Devonian, the second such occurrence recorded in West Texas exploration records, had not been fully determined. The development, however, adds another possible oil zone to the Permian, Silurian and Ordovician which are already proven oil bearing.

Likewise, commercial capabilities of the oil-stained cores from lower Wilcox and Hunton lime recovered by coring in two Carter Oil Co. deep Oklahoma prospects remained to be determined. Evidences so far disclosed, however, probably presage an intensified search for structural conditions along the western flank of the Nemaha ridge already proven by the Moore and West Edmond fields.

Solid line charts current weekly completions

COMPLETIONS IN ALL FIELDS . . .

(Week ended January 8, 1944)

	Oil	Gas	Dry	Total	Footage	Total Comp. to date 1944	1943
N. Y., Penna., W. Va.	29	27	2	58	115,209	58	49
Ohio	4	9	5	18	55,019	18	8
Indiana	2	0	1	3	7,001	3	2
Kentucky	5	1	5	11	19,560	11	1
Illinois	18	0	15	33	81,098	33	45
Michigan	4	0	4	8	23,290	8	11
Kansas	10	0	12	22	71,754	22	24
Nebraska	0	0	2	2	6,695	2	2
Missouri-Iowa	1	0	1	2	3,674	2	0
Oklahoma	15	1	5	21	68,790	21	21
Texas:							
North Central Texas	5	0	11	16	46,070	16	23
West Texas	26	0	5	31	131,136	31	13
Texas Panhandle	0	0	1	1	3,015	1	4
Eastern Texas	3	0	7	10	58,627	10	3
Texas Gulf Coast	4	1	2	7	42,162	7	6
Southwest Texas	4	0	14	18	111,917	18	17
Total Texas	42	1	40	83	392,927	83	66
North Louisiana	2	0	2	4	16,480	4	2
Louisiana Gulf Coast	1	0	2	3	27,377	3	8
Total Louisiana	3	0	4	7	43,857	7	10
Arkansas	1	0	2	3	12,063	3	2
Mississippi and Southwest	0	0	7	7	37,317	7	0
Montana	3	0	0	3	6,177	3	3
Wyoming	0	0	0	0	0	0	3
Colorado, Utah	1	0	0	1	3,454	1	1
New Mexico	0	1	3	4	9,698	4	2
California	31	1	8	40	138,775	40	4
Total United States	169	41	116	326	1,098,358	326	254
Total previous week	200	30	107	337			
Week ending Jan. 9, 1943	142	16	96	254			

PERMIAN BASIN

Wheeler Pool Well Shows Oil From Devonian Formation

MIDLAND, Tex.—Stanolind Oil & Gas Co. and Shell Oil Co., Inc. 2 W. D. Blue, ½ mile south of the same operators 1 Blue which discovered the Wheeler pool in eastern Winkler County, producing from the Ellenburger dolomite, is the second well in West Texas to find oil in the Devonian formation, which lies just below the Pennsylvanian in this area.

Top of the Devonian was encountered at 8,347 ft., and a drill-stem test was run from 8,297 to 8,413 ft., open 3 minutes, and it showed 1,243 ft. of gas-cut mud. Another test open 45 minutes from 8,292 to 8,413 ft., showed gas in 24 minutes, gaging 104,000 cu. ft. per day, and showed 1,365 ft. of gas-cut mud, with 220 ft. of oil-cut mud. Although no test was run on the oil it is estimated to be 40 gravity or above. The first well in West Texas to show oil in the Devonian formation was Magnolia Petroleum Co. 21 State-Walton, Kermit-Ellenburger pool, which topped the formation at 8,220 ft., with fractures showing oil at 8,273-81 ft. The favorable showing in the Wheeler pool well indicates strong possibility of this formation being productive in the Permian basin area, and adds another objective to drilling projects in this reservoir.

Deepest test ever drilled in the Delaware basin is Standard Oil Co. of Texas 1 T. B. Keasler, Section 10, Block 72, PSL Survey, western Reeves County, which was drilling ahead below 8,655 ft. as last week ended. This wildcat topped the Delaware at 3,877 ft., with only slight showings of oil reported.

Pecos County.—Another Ellenburger failure was registered when Globe Oil & Refining Co. and Forest Development Co. 1 Colden, Section 40, Block 10, H&GN Survey, 4 miles southwest of Imperial, was abandoned at 6,336 ft. The well had a good show of oil in the Simpson at 5,257-93 ft. Top of the Ellenburger was called at 4,340 ft. at Humble Oil & Refining Co. 1 Barnes, Section 120, Block 10, H&GN Survey, 5 miles northwest of the Apco-Warner pool.

Yoakum County.—Woodley Petroleum Co. 1 Mittie Farmer, SW SW Section 635, Block D, J. H. Gibson Survey, discovery prospect 2 miles north of Wasson pool, was plugged back to 5,319 ft. from 5,533 ft., drilled out to 5,340 ft., developing 12 bbl. water per hour. Hole was again plugged back to 5,319 ft. where it will be reacidized.

WEST TEXAS WILDCAT COMPLETIONS

Ector County: Danciger Oil & Rf. 1 E. W. Cowden, SW SE 10-42-3s, T&P Sur., elev. 2,668 ft., hard lime 4,560 ft., dry at TD 5,001 ft.

Pecos County: Globe Oil & Ref. and Forest Dev. 1 Colden est., S½ S½ Sec. 40, Blk. 10, H&GN Sur., Yates 1,270 ft., San Andres 2,230 ft., Detrital 5,010 ft., Simpson 5,145 ft., SO&G 5,257-93 ft., Waddell 5,770 ft., dry at TD 6,336 ft.

PANHANDLE

AMARILLO, Tex.—One of the two active wildcats in the Panhandle was about to be put on the completed list, and the other was having trouble with stuck drill pipe. Stanolind Oil & Gas Co. 1 Troy Broome, Section 46, Block 20, H&GN Survey, Donley County, was bottomed at 6,756 ft. in granite, and was plugging back to test after running electrical survey.

In Oldham County, Stanolind 1 W. H. Green, Labor 36, League 320, State Capitol Lands, was unable to free drill pipe at 6,034 ft. in lime. Only one well was completed, according to reports from the district, and it was a dry hole in Gray County, Smith Brothers Refining Co. 1 Harlan, Section 119, Block 23, H&GN Survey, which was drilled to 3,015 ft.

SOUTHEAST NEW MEXICO

HOBBS, N. M.—Center of activity in New Mexico is the Maljamar field of Lea County, which enjoyed a very successful year in 1943, being extended in three directions. Lion Oil & Refining Co. 1 Wyatt, 31-17s-33e, ½ mile south of production in the eastern part of the field, set 5½-in. casing at 4,292 ft., after cutting a bleeding core from 4,286-92 ft. A half mile east of this well, Williams Oil Co. 1 Williams, NE NE 31-17s-33e, had oil show at 4,215-25 ft., swabbing 30 bbl. in 8 hours.

Northern Ordnance 1 Iverson, NW NW 30-18s-33e, 5½ miles south of Maljamar and 2½ miles southeast of Maljamar 2 Cheesman, which had top of pay at 4,645 ft., was at 4,600 ft. The two Ellenburger tests in southeast Lea County continue to make hole. Humble Oil & Refining Co. 1 Federal-Leonard was drilling in black shale at 8,884 ft., and El Paso Natural Gas 1 Ginsberg was drilling at 8,362 ft.

SOUTHEAST NEW MEXICO WILDCAT COMPLETIONS

DeBaca County: Danciger Oil & Ref. 1-A State, 8-2s-26e, Glorietta 1,800 ft., dry at TD 1,895 ft.

Danciger Oil & Ref. 1 State, 26-1s-36e, Yeso 2,010 ft., dry at TD 2,035 ft.

Lea County: H. P. Taubman 1 Sun-State, NE NE, 18-17s-34e, west of Vacuum pool. SSO 4,992-99 ft. in lime, dry at TD 5,043 ft.

DAILY AVERAGE PRODUCTION FOR WEEK

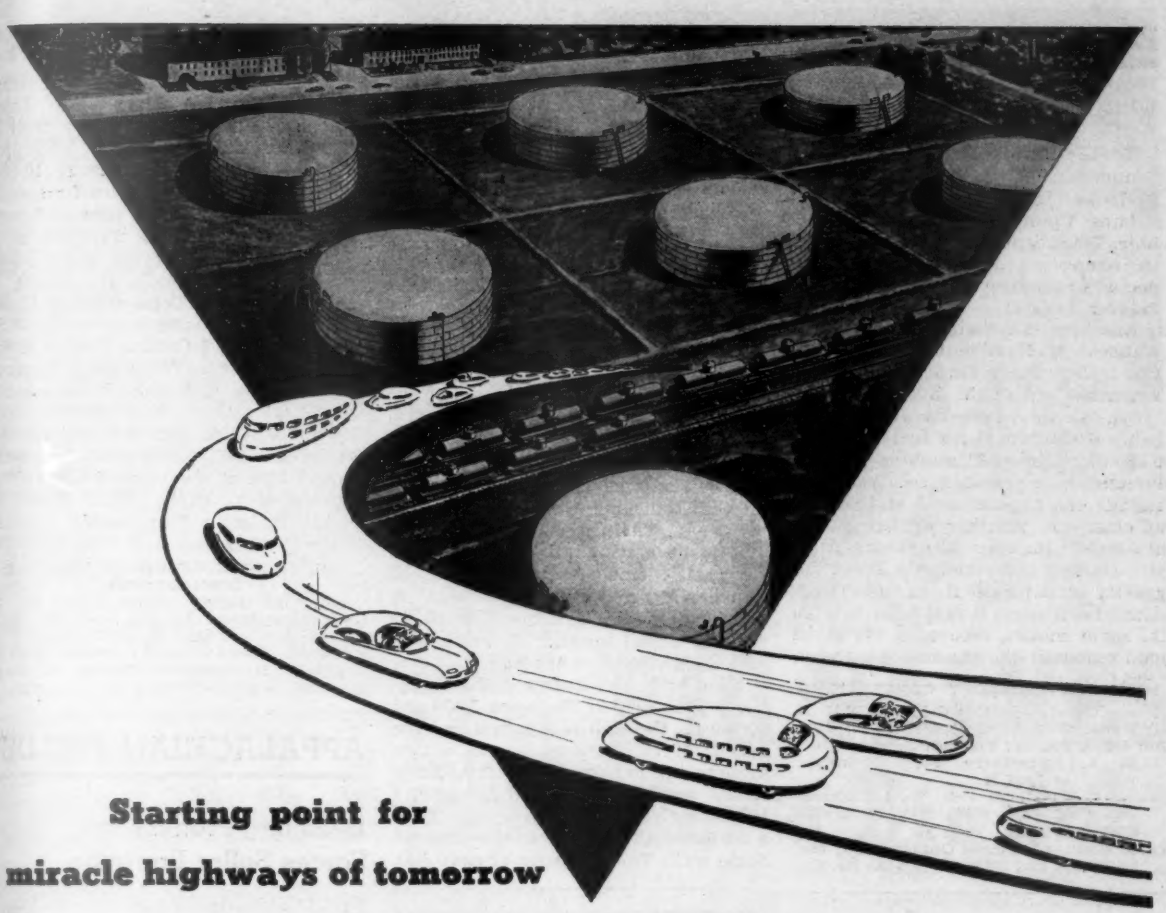
	Jan. 8 crude oil	Distillate, allied products	Jan. PAW quota all oils	Jan. 1 crude oil
Arkansas	79,420	4,800	81,700	79,605
California	790,500	45,500	873,800	797,400
Colorado	7,350	.....	7,000	6,975
Eastern fields	72,950	9,450	83,350	68,720
Illinois	208,600	12,700	227,700	213,550
Indiana	11,830	.....	14,400	13,250
Kansas	265,900	6,200	291,200	265,750
Kentucky	22,625	3,000	29,000	22,120
Louisiana	358,830	32,000	375,700	356,555
North Louisiana	77,920	.....	.....	78,055
Louisiana Gulf	280,900	.....	.....	278,500
Michigan	46,100	200	56,200	44,200
Mississippi	45,680	.....	48,000	46,670
Montana	24,805	300	23,800	21,295
Nebraska	1,500	.....	1,300	1,600
New Mexico	112,600	6,000	116,600	112,400
Oklahoma	332,050	28,000	356,000	327,150
Texas	1,900,100	126,000	2,018,000	1,894,750
East Texas	366,200	.....	.....	364,450
West Texas	365,050	.....	.....	354,000
North Central Texas	140,200	.....	.....	142,650
East Central Texas	116,400	.....	.....	127,100
Texas Panhandle	97,900	.....	.....	95,100
Texas Gulf Coast	714,850	.....	.....	711,750
Southwest Texas	99,500	.....	.....	99,700
Wyoming	85,400	3,400	103,400	86,150
Total United States	4,366,220	277,550	4,707,150	4,358,140

Total production, January 1-January 8, 1944 ..... 34,921,680 bbl.
Same period last year ..... 30,736,690 bbl.

MISSISSIPPI

Jasper County Well Has Show of Oil in Eutaw

JACKSON, Miss.—A new Mississippi oil field in 1944 is expected at Gulf Refining Co. 1 Ellen Morrison, SW¼ SE¼ 30-1n-13e, Jasper County, where work has been resumed following a shutdown at 4,990 ft. for fuel. This wildcat topped Eutaw at 4,740 ft. and Eutaw sand at 4,746-63 ft. Drill-stem test at 4,910-36 ft., open 15 minutes with ⅛-in. top and ¼-in. bottom chokes, recovered 20 ft. oil-cut mud with 850 oil, no salt water. On another drill-stem test at 4,940-70 ft., open 15 minutes, same



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size chokes, recovered 2,090 ft. oil, drilling mud and sand. Operators then recovered about 8 ft. of sand showing oil in a core from 4,970-90 ft. where it was shut down.

The California Co. is preparing for completion test in the 1 Ella G. Lees, 52-7s-1w, in the Cranfield field in Adams County, in the sidetracked hole. Total depth is 4,389 ft. with 5½-in. casing set at 4,389 ft. It is expected to produce from a Wilcox sand around 4,370 ft.

Another Mississippi test being watched is Humble Oil & Refining Co. 1 City Bank Farmers Trust Co., extension test in the Eucutta area of Wayne County, 1-9n-9w. It is drilling below 6,030 ft. in shale. Drill-stem test 5,020-63 ft., open 20 minutes with ¼-in. and ⅛-in. chokes, recovered 120 ft. oil and gas-cut mud and 810 ft. of clean oil. Another drill-stem test at 5,053-79 ft., open 20 minutes, same size chokes, recovered 900 ft. of 29-gravity oil and 120 ft. of salt water. A third drill-stem test at 5,081 to 5,109 ft., same chokes, recovered 210 ft. of mud cut with oil, gas and salt water.

MISSISSIPPI WILDCAT COMPLETIONS

Greene County: Humble O.&R. Co. 1 I. A. Hurst, 33-5n-8w, dry at 12,328 ft.

Jeff Davis County: Freeport Sulphur Co. 1 F. A. Fortenberry, SW¼ 33-6n-19w, junked at 1,895 ft.

Rankin County: Love Petr. Co. 1 Denkman Lbr. Co., NW¼ SW¼ 21-8n-5e, dry at 6,132 ft.

Yazoo County: Northern Ordnance Co., Inc. 1 Koppers Co., NE¼ SW¼ 6-13n-2w, dry at 6,271 ft., top Selma 4,515 ft., top Eutaw 4,828 ft.

FLORIDA

Humble Oil & Refining Co. has spudded 2 Gulf Coast Realties Co., SW SE 30-48s-30e, 1 mile west of the discovery well in the Sunniland area, and the company is preparing to set surface casing.

LOUISIANA GULF

Deep Wildcat Shows Oil To Extend Salt Dome Field

NEW ORLEANS, La. — The old Starks area is holding attention in the Louisiana Gulf Coast district where W. T. Burton has what promises to be a stimulating development for salt-dome operators. His 10 Lutcher-Moore, deep-flank test at Starks dome in Calcasieu Parish, is drilling ahead around 11,400 ft. The test is reported to have had good saturation and sand bodies in the Hackberry-Frio section. Between 9,000 and 10,000 ft., the well is reported to have found 150 ft. of good oil sand in two sections in the basal Hackberry. Other shows were also reported below the Vicksburg shale zone. This wildcat is a mile northwest from the nearest dome well. The company already has staked an offset, the 1 Fairchild, in 13-9s-13w.

Union Oil Co. of California is completing the 1-A State-White Lake, Lease 540, wildcat discovery well in T-14s-2w, White Lake, Vermilion Parish, from perforations at 10,660-75 ft. at the depth where first drill-stem test had flowed gas and condensate. Other tests were made at 10,618-42 ft., recovering gas-condensate, and at 8,356-75 ft., where it showed dry gas. Total depth is 12,000 ft. and 5½-in. casing is set at 10,768 ft.

Sun Oil Co. 1 Central Coal & Coke Co., 25-3s-11w, at Neale field, Beauregard Parish, is testing Wilcox zone. Last perforations were made at 10,780 to 10,802 ft. and the well flowed at the rate of 130 bbl. a day on ⅛-in. choke, and at the rate of 454 bbl. a day on ¼-in. choke. Total depth is 11,201 ft. with 7-in. casing set on bottom.

LOUISIANA GULF COAST WILDCAT COMLPETIONS

Beauregard Parish: Sohio Prod. Co. 1 Lutcher-Moore Lbr. Co., 4-7s-12w, second test at Fields, dry at 8,107 ft.

Calcasieu Parish: Union Sulphur Co. 1 Stark & Brown, 35-11s-12w, at Gum Cove, dry at 9,100 ft.

APPALACHIAN FIELDS

Declining Production Forces Seller Proration

PITTSBURGH, Pa. — Due to the gradual decline in production of Pennsylvania Grade crude, South Penn Oil Co., largest producer and purchaser in the area, has notified all refineries to whom it sells, that during January only 75 per cent of normal will be sold. As all stocks of crude beyond working balances have been exhausted, only oil currently produced is being sold and there is nothing which faintly suggests early improvement in conditions.

During the week, 32 completions were reported from the lower eastern fields of which 4 were dry and 28 gas wells. No new oil was reported.

WEST VIRGINIA

The rotary has been moved in for the completion of Ohio Oil Co.'s wildcat on the Kaemmerling tract, Blackwater anticline, Dry Fork district, Tucker County, and operations will be resumed this week. An attempt will be made to recover the milling tools lost due to gas blowout and which are lodged just below the bottom of the casing set at 7,777 ft. If they are unable to be recovered, then the hole will be sidetracked just below the casing.

Wood County.—West Virginia Gas Corp.'s Peter Seebaugh deep test, Wood County, topped the Big lime at 1,800 ft. and is now drilling at 1,966 ft.

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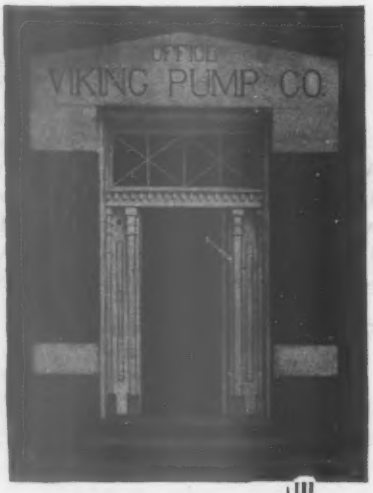

We look forward to Victory . . . to the days of Peace when we shall again be privileged to provide customary, efficient service for civilian customers, large and small, in many industries. In the meantime, keep up-to-date on Viking Rotary Pumps. Write today for our Catalog 42-G, which gives you illustrations, descriptions and complete specifications on every pump in the Viking line. It's FREE and will be sent postpaid to you by return mail.

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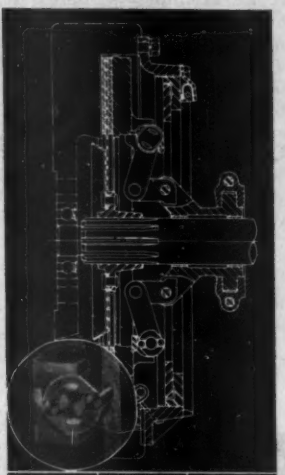

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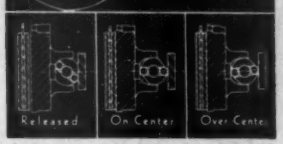

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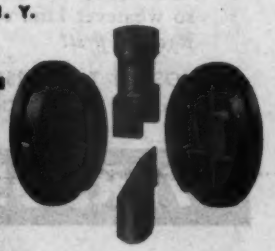


Since 1866

CALIFORNIA

Beldridge and Lost Hills Receive Outpost Tests

LOS ANGELES, Calif.—The expanded exploratory program that took place in California during 1943 has carried over into the present year and indications point to a continuation for several months.

Union Oil Co. of California has made location for a wildcat about 3 miles southwest of the southern tip of the South Belridge field in 18-29s-21e, and Richfield Oil Corp. is starting a test at the southeastern tip of the Lost Hills fields in 5-27s-21e. Union is making a second attempt at Belridge as a shallow wildcat was drilled and abandoned last year. Standard Oil Co. of California's Polvadero wildcat is another attempt to find a high between Kettleman North Dome and the Coalinga Nose field. Amerada Petroleum Corp. has picked up an oil sand in 65-15 California Lands in the Lanare district and may extend the limits of production within the next 10 days.

Inclement weather has retarded wildcat work throughout the state during the past 2 weeks and in several cases wildcat wells were obliged to shut down owing to the discontinuance of natural-gas deliveries to the field. In some cases it was possible to substitute fuel oil but for the most part drilling operations were suspended when gas was cut off to meet emergency domestic demand. The peak demand reached last week also made it necessary for the public utilities to cut off numerous other large commercial accounts. During these periods of peak demand, it is customary to cut off all large users of natural gas or reduce the rate of delivery as the domestic consumer has priority on all available natural gas.

Superior Oil Co. is preparing to spud a projected gas test on the Capay Grant community lease in the Hamilton City district of Glenn County where the company is believed to have found a commercial gas field some time ago. Superior's new wildcat is in 13-21n-2w, about 3 miles southwest of the probable discovery well in 3-21n-2w. In the Afton district of Glenn County, Richfield 1-1 Afton community blew natural gas at a daily rate of 2,900,000 cu. ft. on a formation test at 2,178-99 ft. through a ¼-in. bean and this wildcat may open up a new gas field at that point although drilling was resumed following the 30-minute test.

Dwight G. Vedder failed to recomplete his discovery well west of the Mount Poso field as an oil producer and it has been shut in. Vedder deepened this wildcat to 2,643 ft. but found the lower Vedder of Miocene age barren and on plugging back to 2,500 ft. brought the well in flowing 5,000,000 cu. ft. daily. Vedder's wildcat, the first well to show so much gas in the Vedder zone along the west rim of the San Joaquin Basin, is 1-18 in 18-27s-28e. Vedder's second well on this property is within a few days of completion.

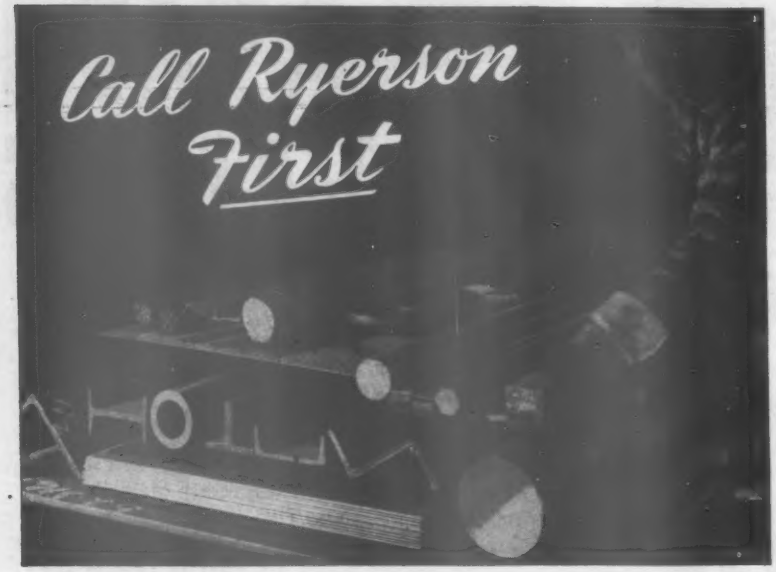
Edwin and Harold Pauley are progressing with their wildcat which is to be bottomed beneath the Los Angeles sewer farm at El Segundo near the tide line. Title to the sewer farm precluded the drilling of a well on the property and hence this wildcat is located on an adjoining lot and will be whipstocked beneath the farm. A wildcat test is scheduled to be drilled on this property in the near future provided the Los Angeles city council approves the proposal. The parcel is generally regarded as having exceptional possibilities due to its proximity to the Playa Del Rey field.

CALIFORNIA WILDCAT COMPLETIONS

Cat Canyon, Santa Barbara County: J. I. Anderson 1 Elliott, 6-9n-32w, abandoned in Obispo tuff, TD 2,455 ft., no showings.

Magunden, Kern County: Seaboard 1 Garrison-Davis, 30-29s-29e, dry hole in hard gray sand, TD 4,103 ft., tight oil sand 2,241-63 ft., not tested.

McKittrick, Kern County: Standard of Cali-



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fornia 22-35 McKittrick, 35-30s-22e, dry in gray shale, TD 3,710 ft.

Puente, Los Angeles County: Lomi Grande Oil Co. 1 McCartney, 14-2s-10w, dry in hard gray shale, TD 3,242 ft., only minor showings logged.

Temblor, Kern County: B. F. DeLanty 69 Temblor, 36-29s-20e, junked at 215 ft., rig skidded 10 ft. for new hole.

Wiley Canyon, Ventura County: Wilshire-Annex 1 Ventura Realty, 1-3n-19w, dry in Sespe sands, TD 5,074 ft.

TEXAS GULF COAST

Shallow Wilcox Discovery Spurs Drilling in Tyler

HOUSTON, Tex.—A revival of interest in the possibilities of shallow production on the eastern end of the Texas Wilcox trend has followed the discovery of oil production by Humble Oil & Refining Co. in the Rockland area, northern Tyler County. Although a small well seems in prospect at the 1 Denman Kountze, Lot 1, Emily Smyth Survey A-792, the entire area is looked upon more favorably. The discovery is undergoing production tests. Earlier test had shown a flow of 43 bbl. of oil in 22 hours on ⅞-in. choke from the perforations at 3,415-32 ft. The hole had been drilled to 8,010 ft. in shale and was plugged back to 3,477 ft. for completion.

Outcome of Sun Oil Co. 1 Maurice Hirsch, James H. Isbell Survey, 4 miles northwest of Huffman, Harris County, is still in doubt, operator having been unable to shut off water. Last test was made in perforations at 8,490 to 8,500 ft. and it flowed about 30 bbl. daily on ¼-in. choke, half being salt water and half paraffin-base crude. Earlier test in perforations at 8,480-90 ft. had shown about the same amount of fluid, 75 per cent being water.

A new Wilcox field for Colorado County is indicated at Jack W. Frazier, Cities Service et al 1 C. K. Gay, about 3 miles northwest of Columbus. Total depth is 8,037 ft. and operators finally cleaned up a bad fishing job and set casing for completion attempt. It is credited with sands carrying shows at 6,775 to 6,800 ft., 6,855-70 ft., and 7,850-56 ft.

An exceptionally large dual oil-sand producer was completed by The Texas Co. at New West Columbia field in Brazoria County, indicating the possibilities of some of the older domes in the Gulf Coast area for flank drilling. This well, the 48 W. H. Abrams, on the west side of the field, flowed 475.11 bbl. a day on ¼-in. choke from perforations at 5,510-20 ft., and flowed 654.04 bbl. per day on ¼-in. choke from perforations at 5,600-15 ft. Both sands showed only 0.1 per cent water. Total depth is 5,737 ft. with 7-in. pipe set at 5,735 ft. Total potential is more than 1,129 bbl. daily from the two sands.

Pan American Producing Co. sidetracked at 7,104 ft. in the 1 Austin College, out on the southwest flank of Raccoon Bend dome, Austin County, William C. Harvey Survey, and is drilling below 7,200 ft. to redrill the top Wilcox sand at 7,300-12 ft. for completion attempt as a gas producer.

UPPER GULF COAST WILDCAT COMPLETIONS

Fort Bend County: Humble O.&R. Co. 1 C. H. Stancliff, in E. Alcorn Sur. A-1, on north flank Sugerland dome, dry at 8,860 ft.

Lee County: Coffield & Robinson 1 John Hornung et al, in W. N. Mock Lge., 8 miles NE of Lexington, dry at 3,630 ft.

Matagorda County: Atlantic Refg. Co. 1-A Denman Kountze, in W. H. Gainer Sur. 550, 9 mi. W of Markham, dry at 8,581 ft. (corrected depth.)

Jackson County: Louis Crouch 2 Lela Stoner, at Mayo field, W. H. Robertson Sur. A-404, opens new gas sand in perforations 5,512-16 ft. TD is 5,536 ft., 5½-in. set at 5,534 ft., 2½-in. at 5,441 ft., no gage on the gas; TP 2,150 lb., spray condensate on ½-in. choke. This was dual completion with perforations at 5,414-19 ft. in upper sand showing 75.68 bbl. a day ¼-in. choke.

MICHIGAN

State Moves to Aid Oil Men in Complying With Regulations

SAGINAW, Mich. — The Michigan Conservation Department last week announced it is streamlining its geological division, making the division a clearing house for the task of getting approval for operating activities from a half dozen departmental divisions. The reorganization is aimed at simplifying compliance by operators. Henceforth, said Dr. R. A. Smith, state geologist, enforcement of regulations in the oil and gas fields will be handled exclusively by the Conservation Department's uniformed division, rather than partly by that division, partly by geologic engineers.

Drilling permit application forms have been redesigned to that end. The department disclosed that oil and gas permits issued in 1943 totaled 627, representing a 10 per cent increase over 1942, and attributed the gain to increased wildcatting and a relaxing of government restrictions. The wildcatting, however, failed to develop any important new fields. Last week the department issued a dozen permits, Osceola and Newaygo counties each getting two, the others going for tests in Allegan, Arenac, Clare, Isabella, Livingston, Mason, Ogemaw and Van Buren.

Field operations in the past week resulted in eight completions for four oil producers, and four dry holes, two of which were wildcat tests. The best well was one in Osceola County which flowed 427 bbl. choked in 18 hours after acid treatment.

MICHIGAN WILDCAT COMPLETIONS

Huron County, Verona Township: Charles W. Teater 1 James T. Todd, C W½ NW NE 5-16n-13e, dry in Berea, TD 1,350 ft.

Saginaw County, Bridgeport Township: Hagan & Hagan 1 Fred C. and N. Gerken, C E½ SE SE 12-11n-5e, dry, TD 3,340 ft.

SOUTHWEST TEXAS

Sun Oil Co. Discovery May Open Major Field

CORPUS CHRISTI, Tex. — A strike of major importance is credited to Sun Oil Co. at 1 A. T. Canales, in CCSD&RGNG Survey 343, near the Kleberg County line and 3½ miles southeast of the Seeligson field in Jim Wells County. Drill-stem test made at 7,221-33 ft. recovered about 3,650 ft. of 39-gravity oil with good gas blow, in 15 minutes, using ¼-in. chokes. Total depth is 7,237 ft. and casing has been set, preparatory to perforating for completion. The company has staked location for the 2 Canales, 1,320 ft. south of the discovery well, in CCSD&RGNG Survey 345. This discovery will probably rank in importance with that in the Scott & Hopper area in Brooks County, where Humble Oil & Refining Co. is making dual oil and condensate completion.

Continental Oil Co. was running a new test at 1 Somerset Land & Cattle Co., a wildcat 15 miles southwest of George West in TTRR Survey 319, Live Oak County. Although no gage was available, it was reported showing for either a high-gas-ratio oil well or a gas-condensate producer from open hole in the Wilcox formation at 8,144-93 ft., total depth 8,547 ft.; 7-in. casing is set at 8,144 ft. A gas show was reported at 8,218-23 ft. but salt water was found at 8,260 to 8,448 ft. The hole is plugged back to 8,193 ft. for the test.

Bee County.—Transwestern Oil Co. and H. B. Zachry Co. 1 Holzmark, which had been expected to open production between the old shallow Voss and Foley fields, has been abandoned. It had shown gas and condensate in perforations at 8,300-10 ft. but salt water broke in and water could not be entirely shut off although other tests higher in the sand were made.

Nueces County. — Stanolind Oil & Gas Co. 2-A Gillett, at Petronilla, is cleaning up fishing job at a total depth of 8,350 ft. It promises to open a new deep sand for the area. Drill-stem test at 8,116-20 ft., open 9 minutes, recovered 395 ft. of 37-gravity oil and 66 ft. of mud with the 2,000 ft. of water cushion. Another drill-stem test at 8,120-25 ft., open 20 minutes,

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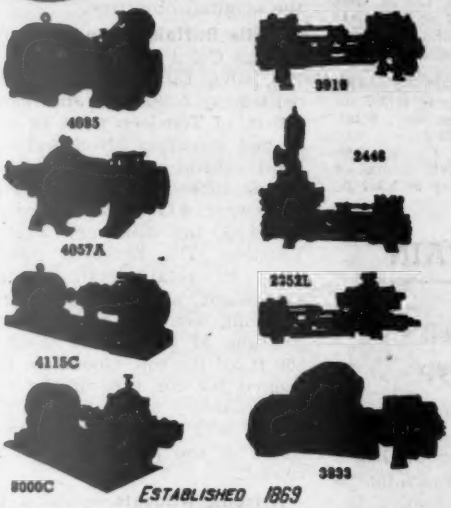

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recovered 1,650 ft. of 37-gravity oil and 144 ft. of salt water.

Bee County. — A new gas pay was opened at Blanconia field by Sun Oil Co. 1 Tuttle, a mile north of the Vicksburg sand production. This well flowed gas with some condensate from pay in the Frio zone, through 7/64-in. choke from perforations at 4,089 to 4,105 ft. The sand was at 4,087 to 4,115 ft. It ran lower than other wells in the field and got salt water in the Vicksburg sand below 5,000 ft.

H. B. Zachry 1 Phillip Brown et al, new shallow discovery well just west of the old Cosden field, 3 miles west of Pettus townsite, T. J. Butler Survey, gaged 76 bbl. a day on ¼-in. choke from perforations at 3,640-45 ft.

LOWER GULF COAST WILDCAT COMPLETIONS

Bee County: Sioux Co. 1 J. A. Handy, in James O'Reilly Sur. A-51, 4 mi. NE of Skidmore, dry at 5,134 ft.

Transwestern Oil Co. and H. B. Zachry Co. 1 Holzmark estate, in Samuel May Sur., A-230, 2½ mi. S of Mineral, between old shallow Voss and Foley fields, dry at 8,919 ft.

H. B. Zachry Co. 1 Phillip P. Brown et al, discovery well in T. J. Butler Sur., 3 mi. W of Pettus and just W of old Cosden field, TD 3,650 ft., top pay sand 3,640 ft., 5½-in. set 3,650 ft., perforated 24 shots at 3,639-45 ft., comp. 12-26-43, PT 76 bbl. day ¼-in. choke, TP 130 lb., CP 560 lb., gravity 41.6, no water.

Aransas County: Continental 7 St. Charles Co., in R. D. Blossman Sur. 109, A-36, southwest outpost at St. Charles field, dry at 9,630 ft. after testing salt water in perforations 8,691-97 ft. and 7,640-50 ft.

Jim Wells County: H. F. Wilcox O. & G. Co. 1 Nicholas Sanchez, in La Tinaja de Lara grant, 4 mi. SW of Alfred field, dry at 5,177 ft.

Nueces County: C. P. Burton 1 W. H. Gentry, on Lot 8, Blk. 1, Nueces River Park subd., 1½ mi. SSW of Calallen, dry at 7,380 ft.

Tom Graham 1 Tom Graham, Lot 52, Geo. H. Paul subd., 2½ mi. NE of Banquete and 1 mi. E of North Banquete field, dry at 7,408 ft.

SOUTH TEXAS WILDCAT COMPLETIONS

Live Oak County: J. H. Durbin et al 1 Paul Maurin, in Stephens Hayes Sur., 2 mi. SW of Whitsett, dry at 923 ft.

Duval County: Magnolia Pet. Co. 53 (209) Duval Co. Ranch Co., NE flank of Government Wells field, dry at 2,347 ft.

ROCKY MOUNTAIN

Steamboat Butte Well Continues to Tensleep

DENVER, Colo. — British-American Oil Producing Co. 2-C Tribal, NE NE SE 31-4n-1w, Steamboat Butte field, Fremont County, Wyoming, is drilling at 6,260 ft., and headed for the Tensleep. It is a northwest offset to 1-C Tribal, completed at 5,144 ft. for 587 bbl. initial in the Sundance sand. Steamboat Butte was a major discovery in 1943, the initial well being started with the intentions of going to the Tensleep, the principal producing horizon at Pilot Butte, just to the south. However, upon finding large production in the Sundance, it was completed in that horizon and two other wells subsequently drilled with the same results. The fourth well is the first expected to reach the original objective.

Little Buffalo Basin.—Stanolind Oil & Gas Co. 1 Unit, SW SW NE 34-48n-100w, Little Buffalo basin, was drilled to 5,297 ft., and penetrated 256 ft. of Tensleep sand, of which 38 ft. had showings of oil and 5 ft. had good saturation. Operators are preparing to test. Location is 3½ miles northwest of Goodstein 1 Pedley-Government, the discovery well in the Tensleep. The latter is standing at 4,965 ft., total depth, waiting for equipment with which to make a pumping test. The fluid continues to rise and at last report stood within 900 ft. of the top. Goodstein has contracted for the sale of the oil from the discovery at 65 cents per barrel, and it will be moved out by truck. Name of the purchaser was not revealed.

Arizona wildcats. — Union Oil Co. of California 1 Aztec Land & Cattle Co., Holbrook structure, Navajo County, Arizona, was abandoned at 3,850 ft., where the drill pipe was stuck. At 3,620 ft., it was believed to be in the Mississippian, and nothing of im-

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portance had been encountered. It was a joint operation with Continental Oil Co. Another well may be drilled in the same general area on another structure. Argo Oil Corp. 1 State, 22-15n-29e, on the Zuni structure, Apache County, Arizona, is drilling at 2,165 ft.

ARIZONA WILDCAT COMPLETION

Holbrook, Navajo County: Union Oil Co. of California 1 Aztec Land & Cattle Co., NE NE NE 19-15n-18e, abandoned at 3,850 ft., drill pipe stuck, probably was in the Mississippian at 3,620 ft.

Byron Field, Wyoming, Lease Acquired by A. B. Cobb & Co.

DENVER, Colo.—A. B. Cobb & Co., operating in the northern Montana fields and also holding large interests at Lance Creek, has acquired W. O. Taylor's holdings in the Byron field in northern Wyoming. The property includes approximately 1,000 acres, of which a considerable part, in 25-56n-97w, is proven territory. Other acquired acreage lies southeast of the Section 25 holdings. Purchase price is reported to have been $650,000.

Two wells have been drilled in Section 25, one completed in 1936 for 600 bbl. per day, and the other in 1942 for 350 bbl. Current production is around 20,000 bbl. monthly.

Cobb is president of the Home Oil & Refining Co., which has a refinery at Great Falls, Mont.

CANADIAN FIELDS

Low-Gravity Oil Becoming Problem in Canadian Fields

CHATHAM, Ont.—A problem in connection with recent developments in Alberta is the finding of outlets for the increasing quantities of heavy crudes. Of the 1943 developments, those which have definitely increased production outside Turner Valley are all in this category.

The Vermilion field in eastern Alberta, with a monthly potential now in excess of 20,000 bbl. is served by a processing plant in the field which cleans and treats the 14-gravity crude for fuel oil, the Canadian National Railways taking the entire output. Production in the Wainwright field, around 14 to 19 gravity and running about 1,500 bbl. monthly, is refined in the field and sold to local trade. The Taber field in southern Alberta, with a monthly potential exceeding 20,000 bbl. and likely to increase with early new completions, is encountering marketing difficulties. Refineries within reach are not equipped to handle this type of crude. Two potential new fields, Lloydminster in eastern Alberta and Athabaska north of Edmonton, are expected to add to the low-gravity production. Actual production from fields outside Turner Valley, last reported at 948 bbl. a day, is mostly low-grade crude, and would be larger if markets could be found. There is a growing feeling that cracking would produce other more valuable products and increase the income to the producers.

Lloydminster.—In the Lloydminster field, eastern Alberta, Sparky 1, rated at 50 bbl. daily, was lost through water intrusion after deepening to 2,005 ft. Sparky 2 is starting in LSD 5, 33-49-1w4. Red Star 1, LSD 12, 11-30-1w4, after coring a promising sand to 1,987 ft., has been shut down until spring. Shaw Petroleum 3, LSD 5, 35-49-1w4, finished at 1,908 ft. with 5½-in. set at 1,903 ft., will test production. Indications are good for development of an extensive field of low-gravity crude similar to Vermilion.

Grassy Lake.—In the Grassy Lake area of the south-central plains, Imperial Oil, Ltd. 1 Grassy, LSD 13, 35-10-13w4, finished at 3,121 ft. with sulfur water and some oil in the lime. Hole has been plugged back to 2,230 ft. to take gas from Bow Island sand. Rig is being moved to LSD 13, 21-12-14w4, 5 miles from Scope, where Im-

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perial 1 Scope will further test the possibilities of the Armelgra-Grantham area, in which Imperial 1 Armelgra last spring had oil showings approximating commercial production.

Wildcat Hills.—Another deep test is in prospect for the Wildcat Hills structure north of Calgary, where Imperial 1 Wildcat Hills, LSD 16, 30-27-5w5, got the cardium sandstone marker at 8,690 ft. and is in lower Benton below 9,754 ft. The Madison limestone, where production is anticipated, is expected around 11,000 ft.

Moose Dome.—South and west of Calgary, and north and west of Turner Valley, Dome Oil & Gas 1 is making new hole on a test of the Devonian limestone on the Moose Dome structure, after sidetracking tools lost at 2,828 ft. Some light oil has been produced from approximately the same depth in Moose Oils 2, in the same general area.

Turner Valley.—Upsetting earlier expectations, British Dominion 7, LSD 12, 17-20-3w5, outpost well in the Turner Valley North Extension, appears to be logging somewhat higher than British Dominion 5, immediately south. It topped Jumping Pound sandstone at 4,430 ft., against 4,970 ft. in No. 5. Continuation of this trend would prove up several new locations.

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EASTERN TEXAS

Panola County Well Showing In Cotton Valley Formation

DALLAS, Tex.—Continental Oil Co. 1 Burnett Bros., Chearis Survey, northeast of Carthage in the big gas-producing area, was reported to be showing oil in the Cotton Valley formation, below the Travis Peak. On drill-stem test from 8,675 to 8,738 ft., open 25 minutes, 60 ft. of oil-cut mud with a slight show of high-gravity oil were recovered. This well, which is surrounded by gas producers from the Pettit horizon, has been closely watched as it penetrated the lower formations in search of oil production. It logged top Paluxy at 2,960, Glenrose 3,914, Massive anhydrite 4,660 ft., Hill zone 5,943 ft., Gloyd 5,005 ft., Upper Pettit 5,965 ft., Lower Pettit 5,850 ft., and Travis Peak at 6,027 ft., with top of Cotton Valley between 8,080-90 ft.

Wood County: Humble Oil & Refining Co. 1 Brewer, Benjamin Lee Survey, southwest of Winnsboro, was to drill ahead toward the Travis Peak after finding the Paluxy and Glenrose horizons dry. At last report it was fishing at 7,905 ft. Plains Producing Co. 1 Mit Cox, southeast of Alba, may be carried to the Smackover after finding no oil in the Travis Peak at 8,822 ft., total depth 9,000 ft. Moncrief & Hyde 1 Simmons, near Golden, was believed to have finally reached the Paluxy, with the top not available as Schlumberger was being run to total depth 6,730 ft. Roeser & Pendleton 1 White, a wildcat west of Mineola, was dry at 7,160 ft. with no Paluxy logged. One of the largest wells at Quitman was Rogers Lacy et al 1-E Johnson Unit, H. Anderson Survey, northeast part of the field, which flowed 972 bbl. in 23 hours through ¼-in. choke and 176 perforations at 6,218-96 ft.

Rusk County.—Second producer for the Henderson pool was assured at Beacon Oil & Refining Co. 1 R. T. Brown, Taylor Brown Survey, which flowed 141 bbl. 60.1-gravity distillate through perforations at 7,227-35 ft. Gas-oil ratio was 25,873 to 1. N. H. Wheless Drilling Co. 1 J. M. Walker, A. G. Walling Survey, a wildcat, perforated with 164 shots at 7,136-65 ft., treated with 2,000 gal. acid, but the well wouldn't flow, and later swabbed salt water.

Smith County.—Preparations were being made to perforate and test Skelly Oil Co. 1 Chism, which is standing at 10,011 ft., with 5½-in. casing cemented at total depth.

EAST TEXAS WILDCAT COMPLETIONS

Cherokee County: B. A. Skipper 1 Mrs. M. E. McClure, 660 ft. from NE & NW, 160-ac. tract, Martin Lacy Sur., elev. 349 ft., Pecan Gap 4,273 ft., Austin 5,097 ft., Woodbine 5,304 ft., dry at TD 5,566 ft.

Kaufman County: M. J. Delaney 1 Rutledge 550 ft. from NE, 600 ft. from NW, 200-ac. tract, Parsons Sur., 4½ mi. N Elmo, dry at 649 ft.

Rusk County: The Texas Co. 1 C. O. Christian, 1,000 ft. from N, 3,600 ft. from E 153-ac. tract, Settoon Sur., 3 mi. W Tatum, elev. 378 ft., Paluxy 4,030 ft., Massive anhy. 5,740-70 ft., base Massive 5,984 ft., James 6,481 ft., Pettit 6,722 ft., Travis Peak 7,030 ft., dry at TD 7,123 ft.

Upshur County: Bobby Manziel 1 P. D. Reynolds, 1,480 ft. from S, 660 ft. from W, 220-ac. tract, Charles O'Neal Sur., 4½ mi. E SE Big Sandy, elev. 332 ft., Pecan Gap 2,560 ft., Austin 3,620 ft., Woodbine 3,758 ft., Georgetown 4,085 ft., Fort Worth 4,726 ft., Paluxy 5,325-35 ft., dry at TD 5,585 ft.

Smith County: Sohio Prod. et al 1 Dela S. Wright, 1,130 ft. N, 13,948 ft. E of NE C F. Gilkerson Sur. in Jose M. Garcia Sur., elev. 307 ft., Pecan Gap 3,014 ft., Austin 4,514 to 4,658 ft., Woodbine 5,070 to 5,830 ft., Georgetown 5,800 ft., Paluxy 7,105 ft., temp. abd. at TD 7,350 ft.

Sabine County: Coline Oil Co. 1 Temple Lumber Co., Larkin Grace Sur., near Pineland, dry at TD 5,236 ft.

INDIANA, KENTUCKY

Hardinsburg Well Opens New Pool in Posey County

EVANSVILLE, Ind.—Sells Petroleum Co., Inc., et al 1 Herman Wade, SE SW NE 14-5s-14w, 2½ miles south of the New Harmony pool, was brought in last week. The well flowed 140 bbl. of oil, natural, in 18 hours from the sand at 2,446-65 ft. Previous to the flow test, 520 bbl. of oil was swabbed in 21 hours. On last report it was shut in to install pumping equipment. Operators are confident that the new well will make from 450-500 bbl. a day on the pump.

Offsets to the discovery well are already under way. Sells Petroleum Co. and Mohawk Oil Co. have set surface casing at their north offset, the 1 Walgrove Corp. in SE NW NE 14-5s-14w. Sinclair-Wyoming Oil Co. has started operations at the south offset at the 1 Elmer Elliott, NE NW SE 14-5s-14w.

EASTERN KENTUCKY

ASHLAND, Ky.—Drilling activities started the year on a slightly upward trend and a number of wells are nearing completion. Only one completion, a gas well, was announced during the week. Several new locations were made and rigging up operations are noted in numerous areas.

The Inland Gas Corp. has completed 250 Eliza Nickles, on Big Branch, Knott County, at 2,965 ft., in white slate with a daily open flow of 119,000 cu. ft. of gas.

WESTERN KENTUCKY WILDCAT COMPLETIONS

Henderson County, 1½ mi. N of Corydon: Sun Oil Co. 1 G. L. Crawford, dry, TD 2,725 ft. in McClosky lime.

Hopkins County, 1 mi. E of Hanson: Pure

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Oil Co. 1 G. B. Hawlett, dry, TD 2,865 ft., St. Genevieve 2,722 ft., McClosky 2,788 ft., show oil.

Webster County: The Texas Co. 1 G. Shields, dry, TD 1,535 ft.

N. CENTRAL TEXAS

Little Wichita Field Extended 1 Mile East

WICHITA FALLS, Tex.—The Little Wichita field of Archer County, 4 miles north of Archer City, received an extension of 1 mile to the east when Deep Oil Development Co. 27 Wilson, Lot 1, Block 119, ATNCL Survey, in the Chalk Hill pool, found the Caddo lime pay that produces at Little Wichita. The extension was completed for a daily pumping potential of 75.73 bbl., and is producing through 22 casing perforations at 4,926-45 ft., and was treated with 4,000 gal. of acid. A new wildcat test to 6,000 ft. was staked by Bridwell Oil Co. on its fee land, 400 ft. from the north and 950 ft. from the east lines, Lot 3, Word and Houston subdivision, 3 miles northeast of Scotland.

Young County.—Possibly opening the first new field in 1944 for North Texas, Hanlon-Buchanan 2-F King, Block 461, TE&L Survey, 6 miles northwest of Graham, kicked off and flowed into pits. Casing had been perforated with 176 shots from 3,908-30 ft., and a treatment of 1,000 gal. acid administered to the Caddo lime pay. Another new pool possibility is A. G. Bednar 1 Finley, Section 6, J. Poitevent Survey, 5 miles northeast of Graham, which topped Caddo lime showing saturation at 3,896 ft., and was drilled to 3,903 ft. where oil rose 250 ft. in the hole. Shows of oil were found in sand at 2,249 ft. and 2,940 ft.

Montague County.—Another good well for the Hildreth Bend conglomerate pool was completed at Continental Oil Co. 2 Jack Hildreth, Section 1, Stafford Survey, on the north side of the pool, which flowed at the rate of 1,464 bbl. per day through ½-in. choke. A new shallow-sand pool was indicated at The Texas Co. 1 L. L. Cobb, Barnes Survey, 13 miles east of Nocona, which encountered its first oil at 2,212 ft., and cored intermittent shows to 2,447 ft., where it went into shale. The hole was carried to 3,394 ft., where electrical survey was run and 6⅝-in. casing was cemented to 2,436 ft. After drilling plug, the hole was shot with 5 qt. nitro, and oil rose 600 ft. in the hole when it was cleaned out.

Hardeman County.—Humble Oil & Refining Co. 1 Dodson, Section 49, Block 10, H&TC Survey, was preparing to reperforate after two 10-shot perforations did not develop production.

NORTH TEXAS WILDCAT COMPLETIONS

Archer County: H. D. Egger 1 Turbeville, 330 ft. from N & W, Blk. 34, Jefferson CSL, dry at TD 1,169 ft.

Clay County: Youngblood & Foree I Nimmo Bros., 660 ft. from N & W, Blk. 21, Graves subd., Orange CSL, southwest of Henrietta, sand SO 3,902-25 ft., 5,512-28 ft., Caddo 5,847 ft., dry at TD 6,410 ft.

WEST CENTRAL TEXAS

ABILENE, Tex.—Increased drilling activity is seen in this district with the start of the new year. In Jones County, which has been the most active county in the district for some time, R. H. Roark has staked location for a 2,750-ft. wildcat test 4 miles south of Anson, SE SE SE Section 17, Block 2, SP Survey, on Myra Caffey land.

Failure in an outpost to the new Hardy pool, 7 miles north of Anson, appeared as Thomas D. Humphrey I Bates, SE SE SE Section 34 BBB&C Survey, was shut down for orders at 3,738 ft. Fain & McGaha were preparing to start operations at 1 Rex Smith, Section 3, Block 17, T&P Survey, a 4,000-ft. test to the Canyon lime, 1 mile north of Patterson pool.

Warren Petroleum Co. 1 W. M. Fowler, NW NW Section 275, Block 1-A, H&TC Survey, Coke County, is to be an Ellenburger test offsetting to the east a small producer from the Cisco.

In Comanche County, F. O. Akin 1 E. G. Houser, C. H. Hefner Survey, is to be a 2,800-ft. test.

In Coleman County, Hunter & Hunter have moved a rig in to 2 C. C. Williams, northwest of their new pool opener in Section 18, Block 2, T&NO Survey, south of Novice, Hunter & Hunter will make another attempt to develop Palo Pinto production in Haskell County at 1 Thomas P. Hughes, 1,830 ft. from south, 660 ft. from west lines of 501-acre tract, M. Travieso Survey, east of a dry hole drilled recently.

WEST CENTRAL TEXAS WILDCAT COMPLETIONS

Coleman County: Discovery. Hunter & Hunter 1 C. C. Williams, 660 ft. from S & E 160-ac. tract, Sec. 18, Blk. 2, T&NO Sur., elev. 2,002 ft., Morris sand 3,275 ft., Gardner sand 3,719 ft., Gray sand pay 3,750 ft., IP 15 bbl., TD 3,788 ft.

Brown County: Central Texas Gas 1 Willie Clark Lynch, 660 ft. from N, 2,000 ft. from W. 294.5-ac. tract, A. S. Worrell Sur., dry at TD 776 ft.

Coleman County: L. H. Wentz 1 J. E. McCord, 990 ft. from S & W Sec. 20, McCord & Lindsey Sur., 3 mi. W NW Glencove, dry at TD 3,757 ft..

Shackelford County: Jones & Stasney 1 E. O. Evans, 1,980 ft. from S, 660 ft. from W, Sec. 21, Bayland Orphan Home Sur., elev. 1,372 ft., dry at TD 3,804 ft.

Taylor County: Lewis Prod. 2 N. D. Teaff, 330 ft. from S & E, Blk. 9, Lge. 122, W. R. Willis Sur., SSO Flippen lime 2,297 to 2,319 ft., est. 50 bbl., dry at TD 3,206 ft.

Throckmorton County: Grisham-Hunter 1-B R. W. Kelley est., 300 ft. from S & E, Blk. 32, Comanche Indian Reserve, dry at TD 958 ft.

Grisham-Hunter Corp. 2-B R. W. Kelley est., 300 ft. from S & W 127.8-ac. tract, Blk. 32, Comanche Indian Reserve, dry at TD 751 ft.

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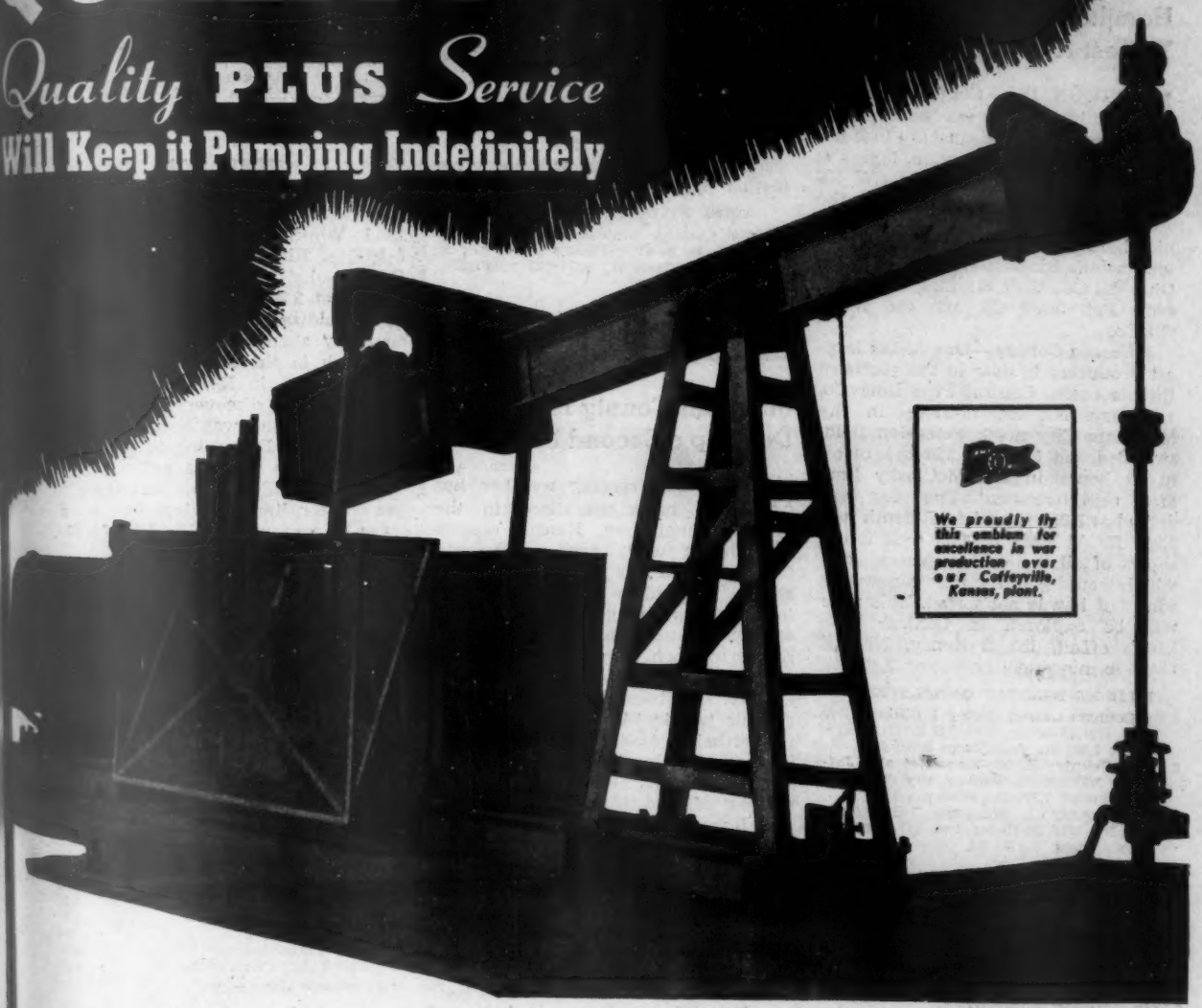

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ILLINOIS

Hamilton County Wildcat To Test Aux Vases Sand

MATTOON, Ill. — Center of interest in Illinois last week was the spot 4 miles north of McLeansboro in Hamilton County, where Layton, Myers & Gibbs 1 Joseph Juergens in SW SE 28-4s-6e was near its objective, the Aux Vases sand, at 3,300 ft. Companies holding acreage surrounding the test include Sinclair-Wyoming Oil Co., Ohio Oil Co., Gulf Refining Co., Magnolia Petroleum Co. and the Wiser Oil Co.

Jefferson County.—One of the largest producers to date in the southern Illinois basin, Central Pipe Line Co. 1 Henry, NE SE 13-2s-4e, in the Markham City north extension field, swabbed and flowed 1,320 bbl. of oil in 19 hours in the McClosky lime after acid treatment. The plug was drilled at 3,052 ft. and total depth was 3,089 ft. At 2,938 ft. this well found shows of oil in the Aux Vases sand, which would give the field a new pay zone but it was not tested. This zone will be explored in Central Pipe Line's offset, the 2 Henry, NE SE 13-2s-4e, now drilling below 2,400 ft.

ILLINOIS WILDCAT COMPLETIONS

Clay County: Carson Corley 1 Billings, SW SW NW 15-4n-5e, dry, TD 2,673 ft., Benoist 2,488 ft., Aux Vases 2,568 ft.

Clinton County: K. McConnell et al 1 Jaffray, NE NE SE 2-1n-3w, dry, TD 1,511 ft., Benoist 1,320 ft., Fredonia 1,493 ft.

Fayette County: L. Waggoner 1 Koebling, NE NE NW 28-5n-4e, dry, TD 2,500 ft., Aux Vases 2,340 ft., Ste. Genevieve 2,418 ft.

Ford County: A. C. Murray 1 Paulson, NW NW SE 1-28n-9e, dry, TD 720 ft.

Hamilton County: Phillips Pet. 1 Federal Chemical & Coke, SE SE NW 8-7s-6e, dry, TD 3,362 ft., Aux Vases 3,137 ft.

Gas Wells Extend Several Ohio Areas

ZANESVILLE, Ohio. — Another large gas well was completed in the South Wayne pool in Muskingum County on the Clara Durant tract, Section 3, Wayne Township. The well gaged 4,920,000 cu. ft. from the Clinton sand at 3,897-3,942 ft. and extends the pool a location to the west. An offset to the west of the well has been staked. In an attempt to extend the pool to the south, the Clinton was found to be dry in the 2 Sletzer, but 579,000 cu. ft. of gas with a rock pressure of 1,200 lb. was found in the Medina sand at 4,072-78 ft., 92 ft. below the top of the Clinton.

A 1,950,000 cu. ft. well on the Haudenschild tract in Section 22 extended the newly opened pool along the north side of Knox Township, Holmes County, a location to the southeast. A location southeast of this well and another west of the discovery well have been staked.

A 1,172,000 cu. ft. completion on the Hoborek tract in Lot 26, Hinckley Township, indicates an extension of the Hinckley pool to the northwest. Two or more wells will be drilled to test the northwest trend.

The extreme southern end of the Brush Creek field, and north part of the Sandyville field each had a good gas completion, which will encourage further drilling.

OHIO WILDCAT COMPLETIONS

Ashland County, Sullivan Township: Pittsburgh O. & G. 1 Dewey Rook, Lot 30, Clinton 2,734-40 ft., dry, TD 2,792 ft.

KANSAS

Sheridan County May Develop a Second Pool

ALTHOUGH freezing weather has halted most operations in the Mid-Continent area, Kansas reports on wildcat wells are considerably brighter than for the past several weeks. A number of new wells are in the testing stage and indications are that Continental Oil Co. may be ready to open a new pool 3 miles north of the Studley pool in Sheridan County. Continental drilled a stratigraphic test in SW SW SE 35-7-26w to just below 4,000 ft. but abandoned it when a fishing job developed. Purchase of considerable royalty around the test after drilling would suggest that favorable showings were found.

Saline County. — Margay Oil Co. 1 Anderson, NW SW 3-16-3w, recent Viola lime discovery, made a potential of 413 bbl. of oil on the pump. The well was drilled to 3,505 ft. in the Simpson but plugged back to 3,386 ft. and perforated. Oil filled the hole 3,000 ft. in 6 hours. The new area has been named the Olsson pool by the Kansas Corporation Commission.

Stafford County. — Stanolind Oil & Gas Co. 1 Syms, S½ NW NE 20-21-12w, north of the Sittner area, was given a temporary potential of 25 bbl. but had indications of making a 200-bbl. well. The hole filled 3,200 ft. with oil while coring in the Arbuckle at 3,587-91 ft., total depth, and swabbed at the rate of 9 bbl. an hour.

Trego County.—J. M. Huber Corp. was preparing to test the Arbuckle at its 1 Cotton, W½ NE NE 26-12-21w. Arbuckle was topped at 3,908 ft. and a core at 3,914-17 ft. contained enough saturation to justify a test of the formation.

KANSAS WILDCAT COMPLETIONS

Barton County: Phil-Han 1 Ludwig, NE NE SW 36-20-13w, dry, TD 3,552 ft., Kansas City 3,22 7ft., Arbuckle 3,489 ft., swabbed 100 ft. of oil and 150 ft. water.

Marion County: N. Appleman 1 Garrett, NE SW 29-18-1e, dry, TD 2,860 ft., Mississippian chat 2,822 ft.

Ottawa County: Stanolind 1 Duggan, NW NW SW 12-12-1w, dry, TD 3,401 ft., Viola 3,169 ft., Arbuckle 3,360 ft.

Reno County: Continental 1 Dunn, SW SW NE 4-24-8w, dry, TD 3,833 ft., Mississippian chat 3,741 ft., Mississippi lime 3,800 ft.

Rice County: Weber Dental Mfg. Co. 2 Evans, W½ N WSW 34-20-8w, dry, TD 3,387 ft., Mississippi lime 3,374 ft.

Rooks County: Lotos Oil Co. 1 Young, SW SW SW 25-8-19w, dry, TD 3,570 ft., Kansa City 3,220 ft., Arbuckle 3,538 ft.

NEBRASKA

ST. JOSEPH, Mo.— Skelly Oil Co. probably will have a small oil well at 1 Winkinson-Beachy in SE SW 3-1n-14e, Richardson County, in the Ogle pool. The Hunton lime was topped at 2,266 ft. and drilled about 20 ft. Acidization is expected. But the company abandoned a Viola test at 1 Roesch in the Barada pool of the same county, in N½ NW 36-3n-16e. This was the discovery well of the Barada pool and was operated in the Hunton lime. Deepening to the Viola failed to open a new zone.

The Ohio Oil Co. was preparing to test Hunton lime showings in a wildcat at 1 Lamporter in NE SW 3-2s-14e, Nemaha County, Kansas.

NEBRASKA WILDCAT COMPLETIONS

Antelope County, S of Neligh: Cove et al 1-A Taylor, N½ NE SW 31-26n-6w, dry, TD 2,625 ft.

Buffalo County: Bell Oil & Gas Co. 1 Burton, SW SE NW 35-10n-16w, dry, TD 4,070 ft.

MISSOURI WILDCAT COMPLETION

Holt County: F. C. Miller 1 J. H. Simpson, NE SW 32-60n-37w, dry, TD 2,276 ft.

CRUDE-OIL PRICES

Representative selected crude prices from all sections of the country appear below:

East Texas	$1.20
Conroe	1.40
Tepetate, Louisiana	1.10
Illinois basin	1.37
Pecos County, Texas	.90
Bradford, Pennsylvania	2.00
Van, Van Zandt County, Texas*	1.00

*No change since 5-21-41.

Gravity Schedules

Top prices include all gravities above grades designated, and low prices include all gravities below grades designated:

Gravity—	Signal Hill, Calif.	Oklahoma, Kansas	Gulf Coast Texas	West Texas*
18-18.9	$0.80	....	....	....
19-19.9	.84	....	$1.06	$0.70
20-20.9	.88	$0.85	1.08	.73
21-21.9	.92	.87	1.10	.74
22-22.9	.96	.89	1.12	.76
23-23.9	1.00	.91	1.14	.78
24-24.9	1.03	.93	1.16	.80
25-25.9	1.07	.95	1.18	.82
26-26.9	1.11	.97	1.20	.84
27-27.9	1.15	.99	1.22	.86
28-28.9	1.18	1.01	1.24	.88
29-29.9	1.20	1.03	1.26	.90
30-30.9	1.23	1.05	1.28	.92
31-31.9	....	1.07	1.30	.94
32-32.9	....	1.09	1.32	.96
33-33.9	....	1.11	1.34	.98
34-34.9	....	1.13	1.36	1.00
35-35.9	....	1.15	1.38	1.02
36-36.9	....	1.17	1.40	1.04
37-37.9	....	1.19	1.42	1.06
38-38.9	....	1.21	1.44	1.08
39-39.9	....	1.23	1.46	1.10
40 and above	....	1.25	1.48	1.12

* Includes Lea County, New Mexico.

Wildcat Completions and Discoveries

NEW oil discoveries were off to a poor start for the first week of the new year but operators are confident of an upward turn, at least by spring. In Oklahoma, oil men are looking for an increase in the number of deep tests over 1944. Carter Oil Co.'s two deep wells on the east rim of the Anadarko basin, which this week are coring shows of oil, are believed to be the forerunner of a series of wells to test this entire area.

The size of the two oil wells completed last week is an outstanding argument in favor of increased prices to spur additional exploration. In Coleman County, West Central Texas, a 15-bbl. well was finished in Gray sand at 3,750 ft. and in the Lower Gulf Coast, Bee County, Texas, H. B. Zachry Co. 1 Phillips P. Brown flowed 76 bbl. of 41.6-gravity oil.

Total completions were 67, compared with 57 for the previous week.

WILDCAT COMPLETIONS

	Week ended January 8, 1944					Cumulative total for 1944				
	Oil	Distillate	Gas	Dry	Total	Oil	Distillate	Gas	Dry	Total
Ohio	0	0	0	1	1	0	0	0	1	1
Indiana	0	0	0	0	0	0	0	0	0	0
Kentucky	0	0	0	3	3	0	0	0	3	3
Illinois	0	0	0	5	5	0	0	0	5	5
Michigan	0	0	0	2	2	0	0	0	2	2
Kansas	0	0	0	6	6	0	0	0	6	6
Nebraska-Missouri-Iowa	0	0	0	3	3	0	0	0	3	3
Oklahoma	0	0	0	2	2	0	0	0	2	2
Texas:										
North Central	1	0	0	8	9	1	0	0	8	9
West	0	0	0	2	2	0	0	0	2	2
Panhandle	0	0	0	0	0	0	0	0	0	0
East	0	0	0	6	6	0	0	0	6	6
Gulf Coast	0	0	0	3	3	0	0	0	3	3
Southwest	1	0	0	8	9	1	0	0	8	9
Total	2	0	0	27	29	2	0	0	27	29
Louisiana:										
North	0	0	0	0	0	0	0	0	0	0
Gulf Coast	0	0	0	2	2	0	0	0	2	2
Total	0	0	0	2	2	0	0	0	2	2
Arkansas	0	0	0	0	0	0	0	0	0	0
Mississippi and Southeast	0	0	0	7	7	0	0	0	7	7
Montana	0	0	0	0	0	0	0	0	0	0
Wyoming	0	0	0	0	0	0	0	0	0	0
Colorado, Utah	0	0	0	0	0	0	0	0	0	0
New Mexico	0	0	0	2	2	0	0	0	2	2
California	0	0	0	5	5	0	0	0	5	5
Total United States	2	0	0	65	67	2	0	0	65	67
Total previous week	7	0	1	48	57					

LA.-ARK.

Union County Wildcat Would Join Two Pools

SHREVEPORT, La.—An important Smackover lime test is under way between Schuler and Mt. Holly in Union County. The well, Atlantic Refining Co. 1 Murphy, NW SW 2-18s-18w, was reported to be coring at an undetermined depth in the lime. Cotton Valley was found at 5,628 ft. and last drilling report showed the well below 7,110 ft. in shale. Operators are hopeful of establishing the Smackover trend between the two pools.

Reports on other Union County wildcats included Lion Oil Refining Co. 1 Union Sawmill, NE NE SW 23-18s-12w, which was drilling below 4,310 ft. J. F. Ellis 1 Winn, SE NE 15-18s-13w, was drilling at 3,620 ft. in shale and lime. An east extension to the Hillsboro pool, Arkhill Oil Co. 1 Union Sawmill, SW SW SW 18-18s-13w, was flowing oil and water by heads after perforating at 2,527-37 ft. and 2,530-41 ft. Total depth is 3,024 ft.

OKLAHOMA

Snow Delays Operations In Mid-Continent Area

OPERATORS in the Mid-Continent area were resuming work after being shut down for several days due to the blizzard which swept this area. At the end of the week Carter Oil Co.'s two deep wildcats in McClain County were coring ahead after receiving several oil shows. Further details on these two wells will be found in the news section of this issue.

Lincoln County.—Stanolind Oil & Gas Co. was coring for the top of the Wilcox sand at its 1 Rohlinger in SW SW NE 29-14n-4e at 5,019 ft. Production was hoped for in the Viola lime, found at 4,940 ft., somewhat lower than expected, but a drill-stem test recovered only oil-cut mud. Location is south of the Chandler area.

Noble County.—Ptak Petroleum Co. 1-A Veronneau, NW SE SE 10-22n-2e, 1 mile east of the Liberty pool, was shut in for connections at the end of the week after flowing some 280 bbl. of oil in 7 hours. The well is in the second sand at 4,397 to 4,402 ft. Since the Liberty only had one well in the Wilcox and was surrounded by dry holes and two shallower Layton sand producers, the 1-A Veronneau may establish the trend of the Wilcox. Additional tests will be made.

Seminole County.—Another new spot was found in an old area at the B. & M. Construction Co. 1 Mathis, SE SE SW 6-6n-6e, west of the Dora field. Cromwell sand was found at 3,102-08 ft. and after drilling plug it swabbed 150 bbl. of fluid in 2 hours, then kicked off to flow into pits. It was shut in for connections, when a production test will be made. Some 5,000,000 cu. ft. of gas was also found in the Earlsboro sand at 2,776 ft. at a pressure of 1,155 lb. Both the Earlsboro and Cromwell sands ran higher than in the Dora field.

OKLAHOMA WILDCAT COMPLETIONS

Pontotoc County: W. A. Delaney 1 Norris, NW SW NE 22-5n-4e, dry, TD 2,935 ft., Hunton 2,425 ft., Viola 2,665 ft.

Stephens County: D. L. Husted et al 1 M. Gibson, SW NW SW 21-1n-7w, dry, TD 1,804 ft.

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SEE COMPOSITE CATALOG—
PAGES 3101 to 3120

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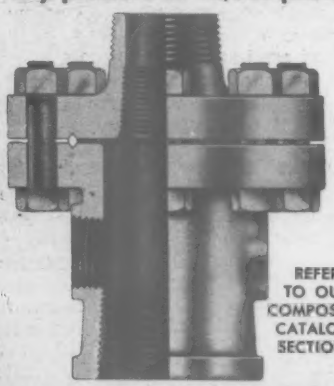

REFER TO OUR COMPOSITE CATALOG SECTION.

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Among the Drilling Contractors

C. O. Noble, Houston, Tex., has the contract to drill Gulf Refining Co. 2 Edna Gibson in the Neale field of Beauregard Parish, Louisiana, 692.8 feet west and 661.2 ft. south of NE C 25-3s-11w. It is an 11,500-ft. test.

Cross Drilling Co., Odessa, Tex., finished a dry hole at 5,001 ft. for Danciger Oil & Refining Co. at 1 Cowden, Section 10, Block 42, Township 3s, T&P Survey, southeast of Odessa and the South Cowden pool.

Helmerich & Payne, Inc., Tulsa, have started operations on a wildcat for company account in Yoakum County, Texas, known as 1 Higginbotham Brothers, SW SW Section 539, Block D, J. H. Gibson Survey, 4 miles west of the lone producer in the West pool. The hole will be carried to 5,500 ft.

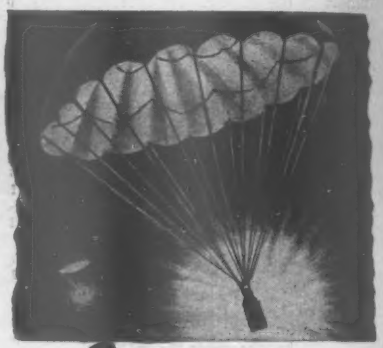
Rex Drilling Co., Houston, Tex., will drill Union Producing Co. 5 Penrod-Jurden Co., 660.2 ft. north and 665.8 ft. east of SW C NW¼ 20-11n-10e, the Holly Ridge field of Tensas Parish, Louisiana. This test to go to the Tuscaloosa field pay, contract depth being 8,400 ft.

Markley-Bankhead Drilling Co., Houston, Tex., is contractor on Amerada Petroleum Corp.'s confirmation test in the Arnaudville are of St. Martin Parish, Louisiana. This second test for the field is located as follows: Start NW C Section 44, go south 15° west on west line of section for 1,508.3 ft., then due east 4,784 ft. to location in 44-7s-5e. It is an 11,000-ft. test.

Commerce Oil Co. (J. H. Blaffer) of Houston, Tex., which drilled Cecil V. Hagen's 1 Wolters, west extension well at Thompson field, Fort Bend County, Texas, is preparing to skid rig to the 2 Walters location on the same lease. The first well is now in process of completion.

Loffland Brothers, drilling contractors, were rigging up rotary tools at the site of Superior Oil Co.'s new location in Gibson County, Indiana, in the area just north of Owensville. It is the 1 Flora Mounts unit, NW NE SE 25-2s-12w.

Francis Fleming is the drilling contractor on the C. Wood 6 Bauldauf, in the Geneva pool about 6 miles south-



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Noble Drilling Co. crew in Oregon Basin field, Park County, Wyoming. The men are: E. E. Everett, driller; D. S. Clothier, M. A. Spoon, Vance Curless, and Casper Kolslad

east of Evansville, Ind., in Henderson County, Kentucky. Contractor was rigging up rotary tools.

Pat. Pending

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Roeser & Pendleton has contract for a 5,000-ft. test in Union Parish, Louisiana. It is the Westgate-Greenland Oil Co. 1 Frost Industries, a wildcat in SE SE 26-22n-1e.

S. B. Roberts, of Abilene, Tex., has been awarded a contract by Warren Petroleum Co., Tulsa, to drill an Ordovician test in Coke County, Texas, just southwest of Blackwell. It is the 1 W. M. Fowler, in C NW NW 275-La-H&TC. An east offset to Coke County's discovery well, formerly Morgan 1 J. S. Craft, which produces 10 bbl. daily from the Cisco, the well will be the sixth in that area.

Ashby Drilling Co. has the contract to drill the Gulf Refining Co. 2 Floyd Van Syckle, in C NW NE 18-16n-7w, Mecosta County, Michigan.

Stuart Godfrey has been awarded drilling contract on the William H. Clock 1 Burgh, in NE SE NE 5-1n-15w, Allegan County, Michigan.

Muskegon Development Co. has the drilling contract on the Gulf Refining Co. 4 T. F. Marston, in C S½ SE SE 1-14n-4e, Bay County, Michigan.

Lupher Drilling Co. will drill the Pure Oil Co. 1 Alger-Newaygo, in C E½ SW NW 8-14n-11w, Newaygo County, Michigan.

O. H. O'Neal has been awarded the drilling contract on Kirega Development Co. 1 Jacob Kort, in NE SW SW 23-7n-13w, Ottawa County, Michigan.

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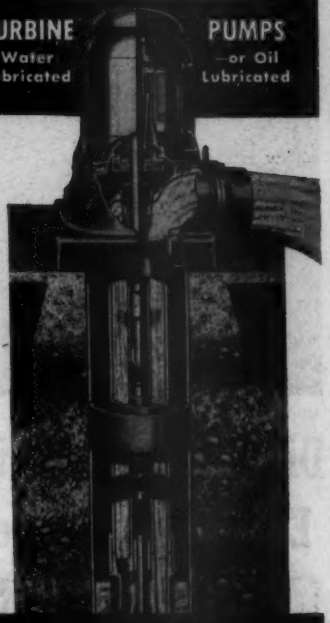

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PERSONALS

Directional Drilling Expert Made Shell Superintendent

CARL LEE, recently appointed general superintendent of Shell Oil Co., Inc.'s Texas Gulf area, is a Kansan by birth. After several years in the oil business he joined the old Roxana company in 1917 as lease foreman at Yale, Okla. In 1918, he enlisted in the Army, and in the following year returned to Yale as a tool dresser.

In 1920, he continued southward to Crystal Falls, Tex., where he became Shell's superintendent for that district. Lee was appointed assistant superintendent of Shell's Gulf Coast area in 1924, and in 1933 became area drilling superintendent for that territory.

He is considered by his associates to be one of the foremost specialists in the field of directional drilling.

Charles N. Noble, second lieutenant, U. S. Army, recently graduated from O.C.S. at Miami Beach, Fla., and is now assigned to duty at Fort Bragg, North Carolina. He is on leave from the transportation department of Shamrock Oil & Gas Corp.

Louis F. Davis has been transferred as production engineer from Baton Rouge, La., to the McKee plant of Shamrock Oil & Gas Corp.

Weldon Burns, who helped to design and construct the first complete 100-octane plant shipped to Russia, is resident engineer on construction of the $6,500,000 aviation-gasoline plant being built by The Frontier Refining Co., Cheyenne, Wyo. Upon its completion he will be assistant plant superintendent.

W. D. Sparks, laboratory tester for Shamrock Oil & Gas Corp., at Amarillo, Tex., and now on military leave, graduated from Air Forces Advanced Navigation School at Ellington Field, Texas, December 24 and was commissioned a second lieutenant.

A. E. Brainard, chief geologist for Continental Oil Co. for the Rocky Mountain area, addressed the Rocky Mountain Association of Petroleum Geologists in Denver, Colo., January 3 on "Pre-Pennsylvanian Stratigraphy of the Front Range."

Henry C. Thompson, pilot for Lee Drilling Co., Tulsa, until his induction into the Army, has been promoted from major to lieutenant colonel. He is with a reconnaissance detachment in the Army Air Corps, stationed at Birmingham, Ala.

Eugene A. Stephenson, head of the petroleum engineering department of University of Kansas, has been named executive director of University of Kansas Research Foundation.

A. M. Schepfer, superintendent of Vickers Petroleum Co.'s refinery in Potwin, Kans., was master of ceremonies recently at a banquet and program marking the company's twenty-fifth anniversary. Arrangements were in charge of **C. N. Davis,** superintendent of pipe lines. **C. L. Henderson,** president, presented service pins to 79 employes. **Charles Foulk** and **George Rhoades** received 25-year pins.

Antum E. Cuthrell, who recently returned from Argentina, has been employed by Humble Oil & Refining Co. as petroleum engineer in the Flour Bluff district, Corpus Christi, Tex.

Maj. W. A. Thomas, Michigan division geologist for Ohio Oil Co., reported at Fort Custer for active duty December 26. Major Thomas received his commission in the Military Allied Command last September. After a month of "hardening" he will be transferred to one of the universities used to train officers for the Allied Command.

Hugh Stephens, superintendent of Arrow Petroleum Co.'s refinery in Centralia, Ill., suffered severe burns December 28, when he tried to fight a fire which started with an explosion at one of the stills.

H. E. (Ed) Hanson was elected a new member of Standard Oil Co. (Indiana) directors effective January 1. His election raises the membership again to 10. Hanson is Standard's senior assistant general manager of sales and will continue in that position as an executive.

L. V. Huston, geologist for Cherry & Kidd, Inc., at Evansville, Ind., has been transferred to the Dallas, Tex., office.

J. J. Schillinger, General Petroleum Corp., Los Angeles, Calif., has been elected vice president of the Los Angeles chapter of the American Right of Way Association.

A. E. Chester, division production superintendent for Magnolia Petroleum Co. in Illinois and Kentucky, has been promoted to assistant general manager of the company's production department and transferred to Dallas, Tex. **J. F. Conley,** formerly stationed at Chase as Kansas district superintendent, succeeds Chester in charge of Illinois and Kentucky. **Russell Clymer** has been promoted to Kansas superintendent.

C. V. McLeod was chosen president of McLeod Oil Co. of Calgary at the recent annual election. Managing director is **C. A. McNabb;** secretary, **George M. Wittichen;** directors, **Clifton C. Cross, Angus McLeod.**

John W. Snedden, for 17 years in the accounting department of United Natural Gas Co. in Oil City, Pa., retired last week on account of ill health.

Marlin E. Sandlin has left the law firm Fountain, Cox & Sandlin, Houston, Tex., to become associate general counsel and secretary of Woodley Petroleum Co. Sandlin was assistant

secretary of state under former **Gov. James V. Allred.**

M. Darwin Kirk, general counsel of Barnsdall Oil Co., Tulsa, was chosen president of Osage Oil and Gas Lessees Association at the recent annual meeting. **George W. Davis,** head of the tax and claims department of Shell Oil Co., Inc., was made vice president, and **Clarel B. Mapes,** general secretary of Mid-Continent Oil and Gas Association, secretary-treasurer.

W. J. Larson was elected chairman of the Los Angeles Basin chapter of American Petroleum Institute at the recent annual meeting in Los Angeles, Calif. **Lloyd Metzner** was named vice chairman; **Dave M. Anderson,** secretary-treasurer; **Knight Templeton,** assistant secretary-treasurer.

S. F. Shaw, consulting engineer, of San Antonio, Tex., is in Calgary, Canada, where he will remain during January.

D. D. Bourland, independent producer of San Antonio, Tex., is suffering from a broken knee, resulting from a fall down a stairway at his home.

Samuel McCoy, formerly an independent oil operator of Corpus Christi, Tex., has returned to that city after an absence of 2½ years, to serve as district superintendent of Republic Natural Gas Co. McCoy, who has been with that company in Refugio, Tex., succeeds **M. L. Ferguson,** transferred to Dallas, Tex.

Dr. Sam H. Knight, head of the department of geology and geography at University of Wyoming, spoke before Illinois Geological Society at Mattoon, Ill., January 10, on "The Physical Evolution of the Rocky Mountains."

Clarence Taylor, chemical-mixing plant stillman at the Marcus Hook, Pa., refinery of Sun Oil Co., was presented recently with a 40-year service emblem.

Ray E. Miller, vice president of Hanlon-Buchanan, Inc., has been chosen president of the Tulsa Area Boy Scout Council.

Fred S. Cook, member of the legal department of Sinclair Prairie Oil Co., Tulsa, was taken to a Tulsa hospital this week, suffering from influenza. It was believed his condition was not serious.

Harry J. Crawford, Emlenton; **Thomas B. Gregory,** Pittsburgh; **Henry Neil Mallon,** Bradford; **John G. Pew,** Philadelphia, and **Thomas W. Phillips, Jr.,** Butler, all of Pennsylvania, have retired as directors of Columbia Gas & Electric Co. They found it increasingly difficult to attend meetings in New York owing to travel conditions and to personal business responsibilities. This change reduces the board to 10 members.

Dallas Lutes, formerly division engineer for Oklahoma Pipe Line Co. at Wewoka, Okla., has been transferred to Jackson, Miss., where he has charge of the company's new office.

Lt. Col. R. F. Garland, independent oil operator of Tulsa, is with the Ninth Troop Carrier Command, New York, on special assignment.

Russell M. Riggins, Bartlesville, Okla., treasurer of Phillips Petroleum Co., on military leave, has been promoted from lieutenant colonel to full colonel. He is on duty in Washington, D. C.

Robert L. Dickey, geologist for Forest Development Corp. in the Midland, Tex., district, has been elected president of West Texas Geological Society. **George R. Gibson,** Richfield Oil Corp., was named vice president, and **Miss Jane Ferrell,** Magnolia Petroleum Co., secretary-treasurer.

Mark Love, Jr., formerly director of research in the Houston, Tex., refinery of Shell Oil Co., Inc., has been made research director at the Wood River, Ill., plant. Love, a graduate of Mississippi College, with a Ph.D. in organic chemistry from University of Virginia, joined Shell in 1935 as junior analytical chemist at Wood River.

W. F. Dalton, chief engineer of a Sun Oil Co. tanker which was torpedoed in the Atlantic Ocean, has been awarded the Merchant Marine Distinguished Service Medal for "heroism and meritorious service beyond the line of duty."

Marshall Sprinkle has been advanced to head of the gas department of the Wood River, Ill., refinery of Shell Oil Co., Inc. He had been assistant. Sprinkle, who joined Shell in 1933 as an experimental chemist, received his M.A. in chemistry and biology from Wake Forest College, North Carolina, in 1929.

E. D. Smith, formerly assistant manager of the production department of Magnolia Petroleum Co., Dallas, Tex., has been elected vice president and manager of production, succeeding **M. J. McLaughlin,** who retired. McLaughlin had been employed by Magnolia since 1912. He became vice president in 1931. He started his career in the oil industry as a roughneck for South Penn Oil Co. in West Virginia in 1898.

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*See "The Abbe Refractometer and the Use of Dispersion Measurement in the Petroleum Industry" by M. G. Brown, Ph. D., which appeared in last week's issue of Oil and Gas Journal, Page 42. Reprints sent on request.

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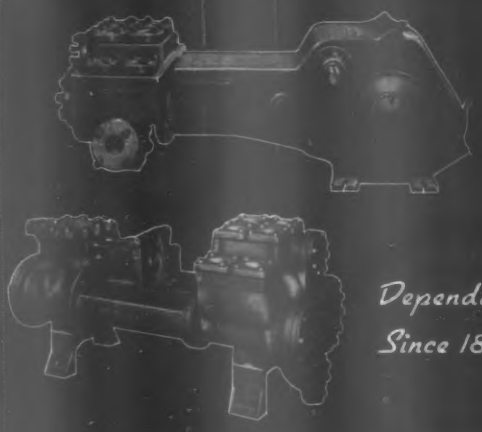

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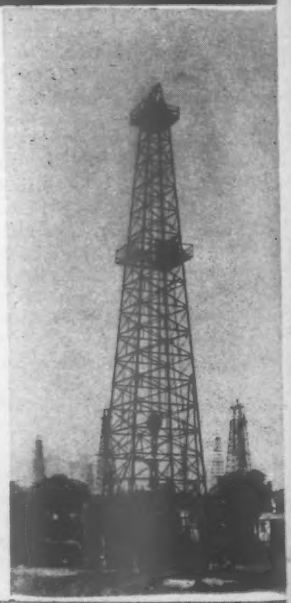

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Market Developments

INCESSANT demand for kerosene in all refining centers of the country again featured petroleum-product markets this week. Much of the current demand is traceable to the short position of kerosene on the East Coast. Efforts of refiners in Districts 2 and 3 to satisfy inquiries from the East Coast result in local shortages at interior points and the call for supplies thus filters back through all marketing channels in the industry.

Mid-Continent refiners reported especially brisk demand this week for distillate fuel oils, reflecting the heavy draft on supplies created by the cold wave which hit the Middle West last week. Furthermore, many consumers are just now ordering new supplies after operating heating plants during the earlier weeks of the winter on gallonage delivered during the off season.

Supplies of heating oil are approximately 85 per cent of normal on the East Coast. The so-called shortage area is in better condition from a standpoint of heating-oil supplies than in any other product. Completion of numerous catalytic-cracking plants in recent weeks has aided the heating-oil situation on the East Coast because substantial volumes of No. 2 fuel are produced by these facilities.

Eastern buyers were reported scouring the market for supplies of motor gasoline. Specifications were subordinated to tertiary consideration in most inquiries. The first question was "do you have any gasoline to ship" and second "are the cars available for transportation." The most acute supply situation in the nation is rapidly developing in motor fuel on the Pacific Coast. A check of reported stocks at California refineries, probably inspired by preparations for the intensified war program in the Pacific, revealed that supplies were distorted substantially by previous inclusion of unfinished stocks which, under existing restrictions, cannot be brought up to standard specifications.

There has been very little change in the muddled gasoline market on the Pacific Coast although plans have been formulated by PAW for the establishment of priority stations which will cater exclusively to defense workers who will be designated as such either through the War Department or some other functional agency.

Unless a more careful check is made on distribution of B and C ration coupons there will still be a considerable amount of unnecessary driving. As matters stand currently it is possible that coupon values will be reduced about January 21 and that A-1 priority service stations will be established in the very near future.

Anticipated increase in the rail movement of refined oil from the Gulf Coast to California has not yet been manifested by arrivals on the West Coast.

Light heating oils are now being impounded in Gulf Coast storage preparatory to starting deliveries of products through the WEP 20-in. line. Currently, however, refiners are reluctant to commit their supplies to the WEP products system, pending settlement of the proposal that it be assigned to crude-oil service and the 24-in. line converted to transmission of natural gas from Texas to West Virginia.

A.P.I. Refinery Report

Week ended January 1, 1944

(Figures in thousands of barrels)

	Dly. crude runs to stills	Stocks: Gasoline	Stocks: Residual	Stocks: Gas oil
Appalachian	150	3,004	352	1,007
Ind., Ill., Ky.	782	15,406	2,526	6,155
Okla., Kan., Mo.	361	7,115	1,018	2,000
Censored area*	2,280	34,497	16,543	22,336
Rockies	106	1,477	701	370
California	774	14,803	35,790	10,563
Total 1- 1-44	4,453	76,302	57,330	42,431
Total 12-25-43	4,185	74,024	57,596	42,431
Total 1- 2-43	3,716	80,472	72,672	44,833

*Reports combined on East Coast, Texas Gulf Coast, Louisiana-Arkansas and Inland Texas at request of PAW.

CRUDE-OIL STOCKS

(Bureau of Mines Estimate)

Week ended:	Bbl. of crude*
January 1, 1944	240,992,000
December 25, 1943	241,310,000
January 2, 1943	233,938,000

*Excludes unrefinable in California.

REFINERY PRICE SUMMARY

(Prices as of January 4, 1944)

Quotations are f.o.b. plant in cars and in cents per gallon except where otherwise noted. They are exclusive of the federal excise taxes of 1.5 cents a gallon on gasoline and 4.5 cents a gallon on lubricating oils, and do not include marine lighterage charges.

REFINERY GASOLINE

Octane (A.S.T.M.):	80†	72-74	68-70	53-66
Mid-Continent*	‡6.00-6.25	5.750-6.000	.....	5.625
Gulf Coast	6.00-6.50	§5.750-6.250	§5.750-6.250	§5.250-5.750
Northeast Coast	9.80	9.2	9.2	.....
California	.....	6.255-6.500	5.750-6.125	5.125-5.500

*Basis Group 3. †1939 C.F.R. (research method). ‡Inland Texas and adjoining counties in Arkansas and North Louisiana. §Unleaded.

KEROSENE AND DISTILLATE FUEL OIL

Product—	Kerosene†	No. 2	No. 3	No. 5	No. 6‡
Mid-Continent*	4.125-4.375	3.500-3.625	3.375-3.500	$0.85	$0.80-1.27
North Louisiana*	4.125-4.375	3.500-3.625	.....	.....	0.80-1.27
Pennsylvania	6.000-6.125	5.875-6.125	5.875-6.000	.....	.....
California	4.500-5.500	5.500	5.500	¶1.10-1.25	¶1.10-1.15
Northeast Coast	6.800	6.700	6.700	1.95	1.65
Gulf Coast	4.125	3.750-3.875	.....	1.35	0.85

*Reflecting OPA ceilings, depending on destination of shipments. †Quotations for 41-43 gravity. ‡Range depends on gravity. §Pacific Specification 300. ¶Pacific Specification 400.

NATURAL GASOLINE

Grades:	26-70	18-55
Oklahoma (Group 3)	4.750	5.700
North Texas	4.375	5.250
North Louisiana	4.375	5.250
California	4.875	5.500

WAX

Oklahoma, 124-126, w.c.s.	4.250
Pennsylvania, 122-124, w.c.s.	4.250
NEW YORK (in bags)—	
Refined, 130-132 (A.m.p.)	7.00
Crude, 124-126 (W.s.)	6.00

LUBRICANTS

PENNSYLVANIA GRADE—	
Bright stock*, 10 pour point	30.5
Bright stock*, 25 pour point	25.0
Steam refined, 600	15.0
Neutral oil†, 10 pour point	34.0
Neutral oil†, 25 pour point	28-32.5

*No. 8 color, 145-155 at 210, 540-550 flash. †150 vis. at 70 F., 3 color, 400-405 flash.

MID-CONTINENT—	
Bright stock, 150-160 D, 0-10	23.00
Neutral oil†, 200-3	15.00

†0 to 10 pour point.

GULF COAST—	
Pale oil, 200-3	8.75
Pale oil, 500-3½	10.00

TANK-WAGON PRICES

(Gasoline prices based on regular grades in cents per gallon).

	Dealer tank wag.	Combined tax	Kero. tank wag.
Baltimore, Md.	15.95	5.5	10.5
New York	16.10	5.5	10.1
Philadelphia	16.20	5.5	11.9
Washington, D. C.	15.20	4.5	11.3
Chicago	14.10	4.5	10.6
Cleveland, Ohio	14.50	5.5	*9.0
Atlanta, Ga.	18.90	7.5	*11.5
Denver, Colo.	14.50	5.5	11.0
San Francisco	14.50	4.5	11.5
Tulsa	16.50	7.0	8.5

*Includes 1 cent state tax.

Astonishing Savings When Using This Effective Pipe Wiper

Available in all sizes

One of the largest oil companies, through its Engineering Department, reports that the saving in time alone, on one of their drilling outfits was enough to pay for their Patterson-Ballagh Pipe Wiper each trip. Before using the Wiper it required 2½ hours of circulation to get the mud back into condition. Based on their cost of $350 per day for well time figured $35 as the saving. This does not include the saving in weight material which is as much more, the insurance against dropping small objects into the well and increased speed due to cleaner floor.

MADE OF PBX ARTIFICIAL RUBBER

The Patterson-Ballagh Pipe Wiper is growing by leaps and bounds in popularity. Once used—always used. It is now made of PBX rubber which has proved exceptionally durable. Try it on one of your wells. Note how the crew "takes to it." There's nothing so effective as this wiper in saving time. Prompt deliveries.

See Composite Catalog

PATTERSON-BALLAGH CORPORATION
Los Angeles 1 • Houston 10 • New York City 6

PATTERSON-BALLAGH PIPE WIPERS

Equipment Progress

Two-in-One "Dozershovel" Announced by Bucyrus-Erie

A new two-in-one dirt moving unit, the Dozershovel for T9 and TD9 International TracTracTors, has recently been announced by Bucyrus-Erie Co., South Milwaukee, Wis.

New Bucyrus-Erie Dozershovel at work as a shovel

The unique design of the Dozershovel provides completely for full-fledged tractor shovel and bulldozer service, with simple interchangeability of bucket and blade permitting in-the-field changeovers in a few minutes. As a shovel, the unit's hydraulic control provides down pressure up to 4,200 lb. for real digging "bites" and big pay loads in a short distance of travel. The same control on the bulldozer provides easy penetration in hard materials and ability to hold the cut. Strong side arms permit the shovel to lift big loads, the dozer to handle any dirt-dozing job. The unit's dumping trip-mechanism gives the dozer a feature unmatched in other bulldozers; ability to tip the blade forward to release the load on uphill dozing.

Other features include unobstructed visibility, low overhead clearance, oscillating tracks and quick, high lift.

An additional feature is the standard hook on the upper edge of the shovel bucket or dozer blade, giving the unit a third application; lifting crane service. This is especially handy in loading or unloading the extra blade or bucket from the truck.

Pemco-Nordstrom Offices Opened in Atlanta

New offices of Pittsburgh Equitable Meter Co.-Merco Nordstrom Valve Co. have been opened in Atlanta, Ga. C. C. Moore, who has been in charge of the Memphis office, is district manager. The offices are located at 411 Bona Allen Building, Spring and Luckie Streets. The Memphis office was closed at the end of December, so that all southern operations formerly cleared through Memphis will now be handled through Atlanta.

Thermoid Co. Acquires Joseph Stokes Rubber Co.

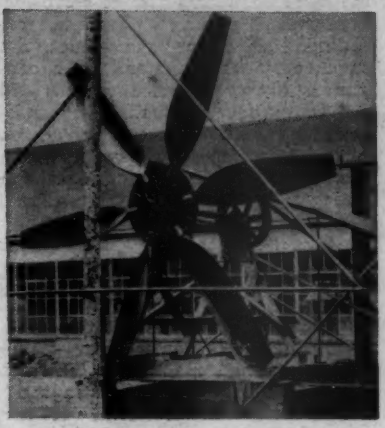
Fred Schluter, president of Thermoid Co., has announced completion of Thermoid's acquisition of the Joseph Stokes Rubber Co.

With the acquisition of the Joseph Stokes Rubber Co. in Trenton, N. J., and its subsidiary in Welland, Ont., Canada, Thermoid's combined sales for the year 1943 should exceed $19,000,000, making it one of the largest rubber companies in the East.

W. J. B. Stokes II will remain as president of the Stokes company, devoting most of his time to manufacturing and engineering problems in that factory.

Panelyte Cooling Tower Fan Blades

The recently developed Hartzite cooling-tower fan blade, manufactured by Hartzell Propeller Fan Co., Piqua, Ohio, is molded of smooth.



shining black, fabric base Panelyte, a structural, laminated resinous plastic material of great strength and rigidity, manufactured by the Panelyte division of St. Regis Paper Co. of New York. Although 62 in. in length and measuring 14½ in. across at its widest section, this new blade weighs only 25 lb. Its low specific gravity, approximately one-half that of aluminum and only one-sixth that of steel, permits a low starting cur-

OKLAHOMA STEEL CASTINGS CO. AWARDED PENNANT

Oklahoma Steel Castings Co., Tulsa, was recently awarded the Army-Navy "E" flag for excellence in production. The "E" pennant was presented to Burtner Fleeger, president of the company (holding the flag at right) by Lt. Col. Richard W. Coward, executive officer of the St. Louis ordnance district (holding flag to left). Others in the picture who took part in the award ceremony were W. G. Skelly, president, Skelly Oil Co.; Lt. Thomas E. McVay, Tulsa district ordnance officer, and Lt. Comdr. E. C. Lawson.

rent surge and a consequent across-the-line starting which reduces the cost of electrical equipment. At the same time, this substantial decrease in blade weight also results in a lessening in bearing loads and further saving in power and equipment.

Panelyte blades are not subject to the more common forms of corrosion. For over 1 year, a Hartzite fan, equipped with Panelyte blades, ran on an open-air test stand, in a constant spray of water, at speeds 100 per cent above normal. Test conditions far exceeded those of actual use, yet no corrosion spot, flaw or weakness developed in any one of the blades.

Trade Literature

Norton Co., Worcester 6, Mass.—A 64-page handbook for operators of internal-grinding machines, entitled "The ABC of Internal Grinding." The manual answers some of the very practical questions which operators have been asking, such as how to select the proper wheel for different internal-grinding jobs and how to correct common grinding faults.

Baker Oil Tools, Inc., 6000 South Boyle Avenue, Vernon Station, Los Angeles, Calif.—Volume 4, No. 6 of Baker News Service, devoted to the Baker rotary casing scraper, with reproduction of actual field reports covering a few typical jobs performed with the instrument.

Armstrong Machine Works, Three Rivers, Mich.—A new illustrated booklet presenting engineering data and complete details on unit steam-type humidifiers. The booklet shows results obtained by automatic humidification, and includes operating features, installation data and other information on these units.

Peerless Pump Co., 301 West Avenue 26, Los Angeles 31, Calif.—A handsome brochure which reveals the activities of the company in the war effort. Virtually the entire production of the Peerless plants is devoted to the production of pumps and amphibian tanks for war use.

Among Equipment Men

J. F. Bechtle Joins Standard Steel

J. F. Bechtle has joined Standard Steel Corp., Los Angeles, Calif., as assistant general manager. He brings to this company wide experience gained through a 20-year association with M. W. Kellogg Co. in New York City. He was connected with the metallurgical and research department and was intimately associated with the development of welding and Pluramelt. He attended Columbia University, studying mechanical engineering.

Paul J. Thompson Appointed Manager

National Radiator Co., Johnstown, Pa., announces the appointment of Paul J. Thompson as the new manager of the Philadelphia branch. He succeeds Harry N. Booth who recently succumbed to a heart attack.

Thompson has been with National Radiator organization since 1936. He started as a salesman at Wilmington, Del., then was transferred to the eastern shore of Maryland territory, and more recently has been covering Baltimore from that branch office.

U. S. Rubber Assigns Two To New Positions

H. F. JOHNSON

Harold J. MacDonald and Howard F. Johnson of the wire and cable department of United States Rubber Co. have been assigned to new positions.

After receiving an honorable discharge from the United States Army, MacDonald's first position with the company was at the Bristol plant in 1920. He was promoted to New England sales manager with offices in Boston in 1921. He held this post until 1938 when he was promoted to eastern district sales manager of the wire and cable department. His new appointment places him in charge of all jobbing with the title of manager, jobbing sales.

Johnson started with the company at the Bristol plant in 1922 immediately after he was graduated from Brown University. Promoted in 1932 to office manager, wire and cable department, he held this position until 1936 when he was elevated to the position of western district sales manager. His new post is manager of branch sales with offices at 1230 Sixth Avenue, New York City.

Classified Advertising

FINANCING

CAPITAL SEEKERS — Interested in raising $25,000 or more for a legitimate project should write to AMSTER LEONARD, Fox Theater Bldg., Detroit 1, Mich.

PATENT ATTORNEYS

PATENTS, Trade-Marks, Booklet, "General Information Concerning Inventions and Patents" and "Free Schedule" sent without obligation. Established 1915. Lancaster, Allwine & Rommel, Suite 418, Bowen Bldg., Washington, D. C.

LEASES AND DRILLING BLOCK

WANTED: Offset or potential producing leases or shallow production, (2,000 feet or less in Midcontinent or California fields. Must have merit, be legitimate, and worth the money. Write P.O. Box 652, Russell, Kansas.

FOR SALE: $10 per acre or ⅛ overriding interest, around 700' 28 to 33-gravity oil. Will guarantee 15 to 30' oil sand if I make the location, or acreage will cost nothing. F. A. Hodge, Wellsville, Kansas.

NEW MEXICO
State Oil and Gas Leases
TWO DEEP TESTS UNDER WAY—one a 7,500 ft. test; the other a 6,000 ft. test, 40 acres and multiples thereof for sale in the HoT SPoT. Write for information. HARRY S. WRIGHT, New Mexico State Leases, Farmington, New Mexico.

FOR SALE: Oil and gas leases and producing leases with offsets to drill. All in shallow territory. W. P. Harley, Bowling Green, Ky.

PRODUCING lease of 600 acres, 12 wells depth 2,000 ft. Extra good equipment, all heavy weight pipe. 1,900 bbl. storage in Ellis County, Kans. Box 378, Cherryvale, Kans.

OIL PROPERTIES WANTED
Attractive blocks with geology for test well and development in active area, anywhere of interest to our people. Details with confidence to: Address Box B-979, The Oil and Gas Journal, Tulsa, Okla.

WEST TEXAS—Greatest activity 1944. PLAY where you have best chance for PAY. New, long term leases, low price, cheap rentals, large or small tracts. Two drilling blocks, potential shallow production. For information and free maps, write F. L. Welch, Sanderson, Tex.

ARKANSAS-Louisiana-Texas leases twenty acres up. Dollar acre up. Owners Box 1122, Little Rock, Arkansas.

OPEN for Oil and Gas Lease: 2,720 acres in one body; and 2,465 acres in disconnected tracts of 160 acres and more, all located in Lost Soldier District, Wyoming. Inquire of L. J. Lincecum, Rawlins, Wyo.

LEASES ROYALTIES
PRODUCING OR NONPRODUCING
Texas, New Mexico, Oklahoma
Louisiana and Illinois.
20 Years' Experience
Inquiries Invited.
B. D. BUCKLEY
60 Broadway Drive, Clayton
St. Louis, Mo.

Classified Advertising

EQUIPMENT WANTED

WANTED to buy: Stationary gasoline or Diesel engine, Diesel preferred, 40-60 hp., also 5 or 6-in. gear pump. Clark's Super Gas Co., 8530 West National Avenue, Milwaukee, Wis.

WANT TO BUY—Grease kettles, pressure and mixing. State type capacity, condition and where located. Box B-961, The Oil and Gas Journal, Tulsa, Okla.

WANTED: Power-driven rotary rigs of 5,000-10,000' capacity. Prefer complete with drill pipe. List specifications of major units, past service record, condition, location and price. Box B-103, The Oil and Gas Journal, Tulsa, Okla.

TWO new or used gasoline power units, 1,000 r.p.m., 25-hp. clutches, electric starting, radiators, first-class condition, modern. State full details, price and where inspection can be made. P.O. Box 366, Ridgewood, N. J.

2,000' TO 5,000' good used 2⅞" o.d. (2½" i.d.) full-hole drill pipe wanted. 2018 W. T. Waggoner Bldg., Fort Worth, Tex.

WANTED

Unlimited quantity of
Structural Steel — Pipe — Tubing
Casings and Valves, all sizes

SONKEN-GALAMBA CORP.
Kansas City (18), Kansas

We Are Interested In Purchasing

Refineries
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No plant is too large or too small for our inspection. Let us quote on your nonproductive properties and aid the nation by critical material reclamation.

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1402-1700 Guinotte Kansas City, Mo.
Phone HArrison 1000

SITUATIONS WANTED

OIL ACCOUNTANT, knowledge of Federal and State taxes, draft deferred. Box B-994, The Oil and Gas Journal, Tulsa, Okla.

EXECUTIVE with thirty years' experience in the oil business part of this time with major company and as vice-president of major independent company also as independent oil producer desires connection with independent company or with parties with money to invest in the oil business as there are many opportunities in the southwest to make money. Box B-262, The Oil and Gas Journal, Tulsa, Okla.

TECHNICALLY trained man, age 45, experience in construction, operation and maintenance of power plants, gasoline plants and refineries. Last 15 years in responsible positions in the oil industry. Now employed as superintendent in small refinery. Desire suitable position with independent oil company. Best of references. Box B-971, The Oil and Gas Journal, Tulsa, Oklahoma.

SITUATIONS WANTED

GEOLOGIST, 18 years experience drilling wildcats and field wells in southwest Texas; now chief Geologist, Independent Oil Company; would consider similar position with operator who would allow personal Royalty and Lease trades. Draft Classification 2-AH. Box B-975, The Oil and Gas Journal, Tulsa, Oklahoma.

DRILLING and Production Supt., or Tool Pusher, 27 years experience, would like connections with small growing company, would take part interest and living salary. Can furnish best of references. Owned own tools and production 15 years. Age 44. Can go anywhere. Box B-981, The Oil and Gas Journal, Tulsa, Okla.

REFINERY SUPERINTENDENT: Now refinery superintendent of large independent, 18 years experience covering cracking, and general refinery operation. Some asphalt experience. Desire change for personal reasons. Age 38, married, with children. Would like connection with progressive independent. Box B-105, The Oil and Gas Journal, Tulsa, Okla.

GRADUATE MECHANICAL ENGINEER is interested in becoming Pacific Coast representative for line of oil-field equipment. 3A; 32 years old; 8 years engineering experience, 5 years with major supply house in sales, service, installation and manufacture of oil-field machinery. Box B-101, The Oil and Gas Journal, Tulsa, Okla.

PROCESS Instrumentation Engineer with 20 years' experience in oil refining, capable of supervising operation topping, cracking and Polyforming units. Good reference. Available Feb. 1, 1944. Box B-102, The Oil and Gas Journal, Tulsa, Okla.

ALKYLATION Plant Supervisor. Thoroughly experienced in operation and maintenance. Do not reply unless proposition is attractive. Box B-999, The Oil and Gas Journal, Tulsa, Okla.

CIVIL ENGINEER, 22 years in South Texas fields, desires permanent position where experience on production, pipe lines, drilling, installation, office management, could be used. C. A. Tips, 1505 West Woodlawn, San Antonio, Tex.

GRADUATE CHEMICAL ENGINEER. Not employed in highest capacity at present. Wants research or supervisory laboratory position with postwar future. Ambitious and adaptable. Experienced topping, cracking, codimer, fuel oil and asphalt. Age 30. Married, 2 children. Box B-967, The Oil and Gas Journal, Tulsa, Okla.

PRACTICAL oil man, 20 years of thorough experience in oil industry, both field and office. Prefer Tulsa connection, now employed. Draft exempt. Box B-994, The Oil and Gas Journal, Tulsa, Okla.

REFINERY ENGINEER would like to associate with refinery equipment or supply house on West Coast. Age 43, thoroughly experienced all types of refinery equipment. Box B-993, The Oil and Gas Journal, Tulsa, Okla.

WOULD like to contact company which contemplates placing man of ability in Mid-Continent area to handle sales, or act as representative in this territory. Ten years in charge of sales for eastern manufacturing company; also 10 years in drilling business. Best of references. Box B-991, The Oil and Gas Journal, Tulsa, Okla.

LAND MAN: Single man, age 30, employed at present, wishes to make new connection along following lines: Abstracter of land titles by profession; wide experience in leases, agreements, contracts, rights of way, payments of lease rentals, damages, etc. Will consider any inquiry; prefer part time outside employment. Any location. Box B-992, The Oil and Gas Journal, Tulsa, Okla.

MIDDLE AGE man wants position as farm boss, or pump and look after production. Reference exchange. Box B-976, The Oil and Gas Journal, Tulsa, Okla.

HELP WANTED

CHEMICAL plant in Detroit area wants experienced or recently graduated mechanical and chemical engineers. Also men who expect degrees in near futture. Important defense work. Write giving references, education, experience and salary desired. Must quality under WMC regulations. Box B-861, The Oil and Gas Journal, Tulsa, Okla

OIL-TRADE publication has position with excellent opportunities for writer with practical engineering experience or training in refinery construction or operation. Previous writing experience not required. Box B-964, The Oil and Gas Journal, Tulsa, Okla.

WANTED: Assistant superintendent for modern Midwest refinery. Must be familiar with plant maintenance and operation. Please give full particulars on past experience and technical training and state draft classification. Box B-100, The Oil and Gas Journal, Tulsa, Okla.

WANTED: Experienced instrument man by large independent inland Texas refiner. Excellent opportunity for advancement. State qualifications and draft status in first letter. Box B-998, The Oil and Gas Journal, Tulsa, Okla.

WELL-KNOWN industrial instrument company desires to expand sales organization looking forward to postwar activities. Splendid opportunity for technically-trained engineers, preferably those with experience in contacting oil industry. Locations open are Houston, New York, Baton Rouge, Pittsburgh, Philadelphia, Los Angeles, and San Francisco. Box B-996, The Oil and Gas Journal, Tulsa, Okla.

WANTED: Experienced salesman for southwest territory by large alloy tube manufacturer. Write to Box B-995, The Oil and Gas Journal, Tulsa, Okla., giving full details.

Old and established Mid-Continent manufacturer wants man to service and sell pumping equipment after preliminary training in factory. If you are interested and available now or later write for details.
Box B-990, The Oil and Gas Journal,
Tulsa, Okla.

NOTICE TO ADVERTISERS

Advertisers offering positions to workers skilled in critical war industries are requested by the War Manpower Commission to include the following sentence in their advertisement:

"Applications from those now employed in war industries will not be considered."

PETROLEUM TAX SERVICE

PETROLEUM INDUSTRY TAX AND COURT SERVICE

Devoted to the needs and interests of the petroleum industry. Monthly. Subscription price, $10 per year. Sample copy sent on request. Leo C. Haynes, Editor; P.O. Box 1024, Austin 6, Tex.

FOR SALE—MAPS

FLORIDA OIL MAP

Over 90 wells drilled for oil tests. Complete list of wells drilled in state giving depth and locations. A good map showing all counties, $1.50 each.

TRI-STATE MAP SERVICE
P.O. Box 287 Daytona Beach, Fla.

FOR SALE—MAPS

685 oil fields in South Texas and Louisiana now mapped and maintained daily; show all intimate details of ownership and development. 2 ft. square. Price $3.50 for each field. Also County and Base Maps.

ZINGERY MAP CO. Houston, Tex.

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Journalisms:

SAFETY is the most important factor an oil-company engineer faces in designing casing strings, concludes H. M. Cooley, in an article that will appear in the Engineering and Operating Section of the Journal next week. He deals with the factors involved in design of long strings of casings. He scrutinizes the properties of steel casing such as collapse resistance, joint strength, internal-pressure resistance, biaxial stress effects, stretching of casing, the effect of temperature change on length and the effect of column loading on strings in compression.

Cooley in manager of field engineering for Bethlehem Steel Co., a position he has held for the past 7 years. Prior to his present post he was associated with various steel companies in Pennsylvania for 20 years, where he engaged in metallurgical and testing work. He is a graduate of Carnegie Institute of Technology, where he obtained his degree in metallurgical engineering.

AN ARTICLE of interest to the refiners scheduled for next week's issue will describe asphaltization tests for lubricating oil. Two types of oil have been found by the investigators, in searching for means of identifying good diesel-engine lubricating oils. One type of oil forms hard granular carbon which does not dissolve and the viscosity of which increases slowly. The other cementizes the carbon so formed in the oil without much precipitation and asphaltizes or solidifies much more rapidly. The result of the test, given in hours before incipient solidification is called the asphaltization index of the oil.

CALENDAR

January

KANSAS OIL MEN'S ASSOCIATION, annual meeting, Broadview Hotel, Wichita, Kans., January 24-25.

February

AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS, annual meeting, Waldorf-Astoria, New York, February 20-24.

AMERICAN SOCIETY FOR TESTING MATERIALS, spring meeting and committee week, Netherland Plaza Hotel, Cincinnati, Ohio, February 28 to March 3.

March

AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS, SOCIETY OF EXPLORATION GEOPHYSICISTS, AND SOCIETY OF ECONOMIC PALEONTOLOGISTS AND MINERALOGISTS, annual meetings, Dallas, Tex., March 21-23.

WESTERN PETROLEUM REFINERS ASSOCIATION, thirty-second annual meeting, Jefferson Hotel, St. Louis, Mo., March 28.

April

NATIONAL ASSOCIATION OF CORROSION ENGINEERS, annual meeting, Rice Hotel, Houston, Tex., April 10, 11 and 12.

November

AMERICAN PETROLEUM INSTITUTE, annual meeting, Stevens Hotel, Chicago, November 13-16.